A B S T R A C T

DIGENETIC TREMATODES OF MARINE FISHES OF INDIA

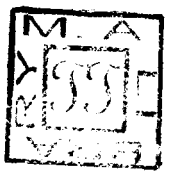
by

HAFEEZULLAH

About 225 species of fishes were examined at various places along the coasts of the Bay of Bengal and the Arabian Sea. Of these, 135 species harboured digenetic trematodes and 90 were found negative. In the present work 89 species of digenetic trematodes from 89 species of marine fishes from the east and west coasts of India have been described or recorded. Of these, 42 species are new including 9 species representing 9 new genera; 47 are previously known species both from India and from elsewhere, including 1 species for which a new genus has been erected; 3 are unassigned species and 1 is a larval form. Five synonymies, 2 new combinations and 1 new name have been proposed. Keys to the species of Paropecoelus, Decemtestis, Diploproctodaeum, Lepidapedon, Prosogonotrema and Tormopsolus have been provided. Acanthocolpus lühei Srivastava, 1939 has

been revalidated. A review of the genus Decemtestis has been presented, and a new genus Allodecemtestis has been erected for Decemtestis biacetabulata Srivastava, 1936. The validity of the related genera of Hamacreadium and Helicometra have been discussed. Cainocreadoides epinepheli (Yamaguti, 1934) Nagaty, 1956 has been transferred back to Hamacreadium. The zoogeography and host-specificity of these trematodes have been dealt with. A qualitative and a quantitative comparision of Digenea of the fishes of east and west coasts have been made. The digenetic trematode faunas of the Indian region, and of the various other parts of the world have been compared. A host-parasite list and a list of fishes found negative for digenetic trematodes have been provided.

DIGENETIC TREMATODES OF MARINE FISHES OF INDIA



A Thesis

Submitted to the

Department of Zoology

Aligarh Muslim University, Aligarh.

by

Hafeezullah

In Fulfillment of the

Requirements for the Degree

of

DOCTOR OF PHILOSOPHY

November, 1968

DEPARTMENT OF ZOOLOGY
ALIGARH MUSLIM UNIVERSITY
ALIGARH, U. P. INDIA
November 11, 1968

This is to certify that the thesis entitled "Digenetic Trematodes of Marine Fishes of India", which is being submitted by Mr Hafeezullah (1) embodies original work done by the candidate himself, (2) that the work has been done under my supervision between 1964 and 1968 and (3) that I allow him to submit the same in fulfilment of the requirements for the degree of Doctor of Philosophy in Zoology of this University.

Ather H. Siddiqi
Supervisor

Dedicated

To

My

Father & Mother

In

Gratitude

ACKNOWLEDGMENTS

The author wishes to express his thanks to Dr. Ather H. Siddiqi under whose supervision this work was carried out.

Thanks are also due to Late Professor M.A. Basir and Professor S.M. Alam for providing research facilities in the department, and to Professor H.W. Manter for his helpful suggestions. The author is also indebted to Dr. S. Jones, Director, Central Marine Fisheries Research Institute, Mandapam for providing laboratory facilities at the various substations of the Institute. Thanks are also due, to the staff of the Institute in general and to Mr. P.D. Punwani of the C. M. F. R. I., Bombay, in particular for identifying the fish hosts. Acknowledgment is extended to Mr. Sibte J. Kazmi for typing the draft copy of the thesis.

This investigation was financially supported by a research grant of the Council of Scientific and Industrial Research, Government of India, for which the author is highly grateful.

CONTENTS

INTRODUCTION

The digenetic trematodes of marine fishes have received due attention only since the beginning of the 20th century. The knowledge of these worms has developed and become extended through the years with the gradual development of modern means and tools for fishing. This has been particularly so in the case of the trematode faunas of the deep sea fishes. Many seas and oceans have been explored in recent times and the trematode faunas of both deep sea and shallow water fishes have been studied and recorded. The digenetic trematodes of marine fishes of the British waters, the North Atlantic and North Pacific Oceans, the Mediterranean and Red Seas, and the Australian, Philippine and New Zealand waters are more thoroughly known today than ever before. Studies have included not only the taxonomy of the group, but also other related aspects such as the host-parasite relationship, host-specificity, pathogenecity, incidence of infection, life history and zoogeography of these trematodes. The Russian contribution in some of the fields mentioned above has been quite significant.

Since the Indian peninsula is surrounded by vast expanses of marine waters, the Bay of Bengal on the east coast and the Arabian Sea on the west coast, and since the

fishing conditions are eminently satisfactory, there is good scope for an exhaustive study of these worms. However, the work done so far on this subject is far from extensive. Srivastava in 1935 initiated the study of these trematodes on this subcontinent. In a series of papers (1935-1942) he reported a large number of genera and species from the fishes caught off the coast of Puri (Bay of Bengal) and Karachi (Arabian Sea). In spite of the fact that he is the only major worker and contributed the largest number of papers in this field, some of his papers were presented to various meetings of the Indian Science Congress in abstract form only, and no detailed descriptions and diagrams have been published. Such contributions are of no taxonomic value and thus to avoid confusion all such species should be considered nomen nudum. Chauhan (1943-45) worked on the trematodes of the fishes of Bombay. However, his main work is one of compilation of the trematode fauna of India in general, which is still incomplete. Only four parts (1954) dealing with the Monogenea, Aspidogastrea, Gasterostomata and Hemiuridae have so far been published. Gupta (1956) and Job (1961-66) have examined some fishes of the Gulf of Mannar and adjacent waters and have reported a few new species. So far, a total of 68 valid species of digenetic trematodes belonging to 46 genera from about 60 species of

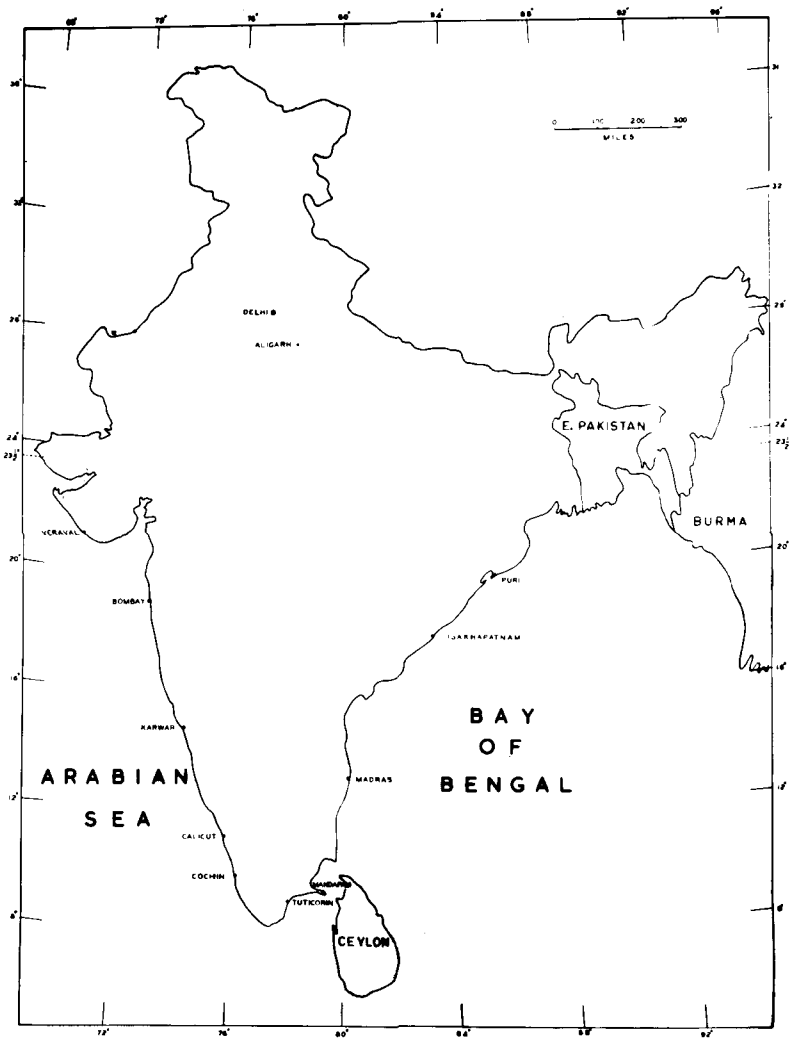
fishes of the Bay of Bengal and the Arabian Sea have been recorded.

Most of the above work has been reported from only a few places on the coastline which, however, spreads to 5,689 Kms. and the variety of marine fishes in these waters is also large. There are about 1500 species of marine fishes, native to Indian waters. If one keeps in view these facts and also the small number of species of digenetic trematodes reported from a fraction of the total number of species of fishes, it becomes immediately apparent that the necessity for extensive study of these animals still exists. As a matter of fact, the study of this group has been badly neglected in India. Moreover, the data provided by earlier taxonomic studies of these trematodes was not analysed and made use of to deal with the related aspects of the problem. The knowledge of digenetic trematodes of marine fishes is important, in addition to their taxonomy, from the point of view of their geographical distribution and of the evolution of parasites and hosts; the study of these animals is important not only from these pointes of view but also because it is intrinsically fascinating.

The necessity for some extensive work in India on this group has long been felt in this laboratory. But only in 1963 was it possible to begin work on a prelimi-

nary basis: Dr. A.H. Siddiqi visited Bombay and examined a large number of marine fishes and made a collection of these worms. This work, however, could not be carried out by one man on the necessary scale. In 1964, therefore, an extensive research scheme of work on these parasites was submitted to the C.S.I.R.; financial assistance was obtained from that source, and present writer was employed as the Junior Research Fellow under that scheme.

Survey and collection work was carried out between October 1964 and February 1966 in the following places: Visakhapatnam (including Waltair), Madras, Mandapam, and Tuticorin on the east coast, and Cochin, Karwar, Bombay, and Veraval on the west coast. Laboratory facilities were provided by the Central Marine Fisheries Research Institute at its sub-stations in the above mentioned places. Over a thousand marine fishes belonging to 225 different species were examined, and nematodes, cestodes, trematodes and acanthocephalans were collected. However, the present monograph is confined to the taxonomy and geographical distribution of the digenetic trematodes. It includes a total of 66 genera and 89 species of known and new trematodes. Given the variety of fish fauna of the Indian coast and the number of new and old species and genera described or recorded here, it will be under-



Text Figure 1. Map of India showing places of collection of trematodes.

stood that while an attempt has been made, an exhaustive study of this group is yet far from complete. Further study of the fishes of Indian marine waters will certainly reveal many more trematodes yet unknown to man.

METHODS

The fishes were obtained from the commercial fishermen, either at the landing places, or from the fish markets. These fishes were caught with the help of nets, hooks and line or shore seines, Some of the deep sea fishes were obtained from the Indo-Norwegian Project Trawlers, if they were operating in the vicinity at the time. Therefore, trematodes of both deep sea and shallow water fishes are represented here. All fishes were identified with the help of the staff of various units and Sub-Stations of the Central Marine Fisheries Research Institute and the two main references used for this work are Day (1958) and Munro (1955). The fishes were examined for worms while they were as fresh as possible; in no case were iced fishes used. The fishes were opened for examination in normal saline and after removal from the host, the trematodes were washed with, and allowed to relax in, the same medium. In as many cases as possible, in so far as time permitted, the trematodes were examined alive for various features, the extent of the excretory bladder among them After complete relaxation, the worms were fixed in AFA fixative under either a coverglass pressure or a piece thereof, depending upon the size and texture of the worms For stout and highly muscular trematodes slides were used for pressing. After fixation, the parasites were

removed, kept in AFA separately for some time, washed in 70% alcohol to remove excess of AFA, and finally stored in 70% alcohol in air-tight small screw-cap glass vials. These trematodes were stained with borax carmine or haematoxylin. They were cleared in clove oil with a final rinse in xylol and were mounted in Canada balsam. Worms were serially sectioned whenever required.

The diagrams were drawn by the microprojection method, and all measurements in descriptions and scales of the diagrams are in millimeters unless otherwise stated. In most cases the sucker ratio has been calculated by adding averages of lengths and breadths of suckers and taking the oral sucker as one. One asterisk indicates new host records and two asterisks indicate records of new locality. The diagrams of specimens of known species have also been included in the present work in order to show any variations from the original diagrams, as well as for the sake of completeness. Wherever the uterus greatly overlaps other organs, it has been omitted in the diagram so that other organs can be shown. The holotype specimens of all the new and representatives of the known species have been deposited in the Helminthological Collection of the Museum of the Department of Zoology, Aligarh Muslim University, Aligarh, India. Skrjabin (1947-62) was consulted wherever original

literature was not available. The abbreviations of the titles of journals cited in the references are according to the List of Serial Publications with World List Abbreviations published in the March, 1966 issue of the Helminthological Abstracts. Wherever locality has not been mentioned separately, it follows the name of the host.

DESCRIPTION AND DISCUSSION OF SPECIES

Family Bucephalidae Poche, 1907

Prosorhynchus epinepheli Yamaguti, 1939

Plate I, Figure 1

Hosts: *Epinephelus undulosus** Quoy and Gaimard, from Tuticorin**

*Epinephelus chlorostigma** (Val.), from Tuticorin**

*Serranus diacanthus** Cuv. and Val., from Karwar**

*Serranus waandersii** Bleeker, from Veraval**

Site: Intestine

A number of specimens of this trematode were obtained from the above fish hosts all belonging to the family Serranidae. They all agree fairly well in most details with Yamaguti's (1939) description. Some important variations are, however, noted in the configuration of the testes, extent of the intestinal sac with respect to the anterior border of the ovary and the number of vitelline follicles. The two testes may be arranged as originally described or they may be symmetrical or the left one anterior to right one. In the latter case, the pharynx becomes entirely posterior to the testes. In all the Indian specimens the intestinal sac extend far anterior to the ovary. The number of vitelline follicles varies between 22-26.

In one specimen the vitelline follicles are not confluent medially just behind the rhynchus.

Prosorhychus atlanticus Manter, 1940

Plate I, Figure 2

Host: Serranus salmoides* (Lacépède)

Site: Intestine

Locality: Karwar**

Except for the reverse arrangement of the testes (i.e., left one is anterior to right one) there is no fundamental difference between the present specimens and Manter's description.

Prosorhynchus chorinemi Yamaguti, 1952

Plate I, Figure 3

Host: Chorinemus tala* Cuv. and Val.

Site: Intestine

Locality: Madras**

Only one specimen was recoved, and it varies from the original description based also on a single specimen, in various body measurements; testes not separated by the loops of the uterus and in the absence of "dorsoventral muscle bundles grouped in the form of an inverted V in front of anterior end

of uterus."

Prosorhynchus tsengi Tsin, 1933

Plate I, Figure 4

Synonym: Cotonius platycephali Yamaguti, 1934

Host: Platycephalus scaber* (L.)

Site: Intestine

Locality: Cochin**

Rhipidocotyle septapapillata Krull, 1934

Plate I, Figure 5

Host: Psettodes erumei* (Bloch)

Site: Intestine

Locality: Visakhapatnum**

Eight specimens of this species were recovered from the above fish host. In the nature and structure of anterior sucker and papillose hood, and topography of the various internal organs they appear to be R. septapapillata. However, the body is not truncated particularly in the anterior region; the eggs are smaller, 15-21 x 15-18 μ. In these details, the present worms differ from R. septapapillata which has a truncate body with almost same width throughout and much larger eggs, 38 x 17 μ on the average in stained

and mounted specimens and 42 x 18 u in fresh specimens. Chauhan (1943) recorded it from Chrysophrys berda from Bombay and noted that the body was very much longer than Krull's specimens.

Alcicornis thapari+ n. sp.

Plate II, Figures 6,7

Description (Based on 4 specimens): Body 2.822-3.67 long, 0.259-0.306 wide, elongate, subcylindrical, slightly tapering anteriorly, posterior end rounded. Cuticle spinose. Rhynchus 0.105-0.122 long, 0.108-0.116 wide, wedge-shaped, provided with short tentacles (probably 7). Mouth ventral, postequatorial, at about junction of middle and posterior one third of body; pharynx 0.078-0.102 in diameter, backwardly directed; intestine saccular short. Testes 0.14-0.196 by 0.131-0.175, tandem, separated, in middle of posterior one third of body, to right of median line. Cirrus sac 0.482-0.518 by 0.119-0.164, cylindrical, in posterior part of body, hardly reaching posterior testis, containing a saccular seminal vesicle and a long pars prostatica surrounded by prostatic gland cells. Genital atrium 0.14-0.164 by 0.111-0.14, quite wide. Genital pore ventral, at a short distance in front of posterior end. Ovary 0.087-0.14

+ Named after Prof. G.S. Thapar.

in diameter, globular, pretesticular, contiguous with anterior testes. Uterine seminal receptacle present. Vitellaria follicular, in two lateral groups in middle one third of body. Uterus reaching posteriorly behind genital atrium and anteriorly to anterior level of vitellaria. Eggs 15-22 x 7-15 μ, thick-shelled. Excretory vesicle tubular, reaching slightly anterior to middle of body; pore terminal.

Host: Caranx sexfasciatus Quoy and Gaimard

Site: Intestine

Locality: Tuticorin

The following 5 species have been named in the genus Alcicornis Mac Callum, 1917: Alcicornis carangis Mac Callum, 1917 (as redescribed by Nahhas and Cable, 1964), A. balysi Nagaty, 1937, A. longicornutus Manter, 1954, A. cirrudiscoides Velasquez, 1959 and A. siddiqii Nahhas and Cable, 1964. The present species differs from the first two in the shape and size of rhynchus, nature of tentacles and the distribution of vitelline follicles. It further differs from A. carangis in the extent of cirrus sac with respect to the position of gonads. It also differs from A. longicornutus in shape and size of body, length and nature of tentacles, distribution of vitellaria, position of mouth and

relative positions of gonads and cirrus sac; from A. cirrudiscoides chiefly in the absence of "peculiarly shaped, concave, diso-like" anterior end of cirrus sac and size of eggs (34-39 x 21-26 μ in A. cirrudiscoides) and from A. siddiqii in the nature of tentacles, position of gonads and cirrus sac with respect to that of testes and distribution of vitelline follicles.

Dollfustrema sp.

Plate II, Figure 8

Description (Based on a single specimen): Body 4.152 long, 0.859 wide, elongate, spindle-shaped. Cuticle with spines on entire body. Anterior sucker 0.494 by 0.553; spines probably lost. Mouth almost midventral, slightly preequatorial, surrounded by well developed muscles; pharynx 0.255-0.263 in diameter, globular, highly muscular, followed by an esophagus; intestine saccular, extending posteriorly almost up to anterior level of ovary. Testes unequal, anterior one 0.659 by 0.518, quite large, almost in midbody; posterior one 0.426 by 0.33, far smaller than anterior one and widely separated by ovary and uterine seminal receptacle. Cirrus sac 0.6 by 0.106, largely cylindrical, enclosing a winding, tubular seminal vesicle and a pars prostatica surrounded

by gland cells; slightly overlapping posterior testis. Genital atrium 1.065 by 0.071, elongate conical; long, narrow, tapering genital lobe present, projecting into genital atrium. Genital pore ventral, in front of posterior end. Ovary 0.324-0.365 in diameter, globular, intertesticular. Uterine seminal receptacle present. Vitelline follicules large, 0.068-0.152 in diameter, in two lateral groups, 18 in right and 20 in left, distributed in middle of body. Uterus extensive, from posterior end of cirrus sac to posterior level of sucker. Eggs 14-17 x 13-15 μ, thick-shelled. Excretory vesicle undetermined.

Host: Gymnothorax undulatus (Lacépède)

Site: Intestine

Locality: Visakhapatnum.

Except for the absence of spines in the adhesive organ and the posterior direction of the intestine, this specimen appears to be a member of the genus Dollfustrema Eckmann, 1934. Since only one specimen is available, this worm is not assigned to any species.

Family Cryptogonimidae Ciurea, 1933

Mehracola ovocaudatum (Srivastava, 1939) Manter, 1947

Host: Lutianus johnii* (Bloch)

Site: Intestine

Locality: Karwar**

Pseudallacanthochasmus grandispinus Velasquez, 1961

Plate II, Figure 9

Host: Pomadasys hasta* (Bloch)

Site: Intestine

Locality: Cochin**

Velasquez (1961) described it from a snapper from Luzan Island, Philippines. The Indian specimens from a grunter are smaller in body size, have 28 (instead of 23-25) circumoral spines, and do not have incision in the ventral margin of the oral sucker.

Metadena karthai+ n. sp.

Plate II, Figure 10

Description (Based on one specimen): Body 2.094 long, 1.382 wide, ovate, cervical region provided with

---

+ Named after Mr. K.N.R. Kartha, Central Marine Fisheries Research Institute, Mandapam (Madras).

gland cells. Cuticle aspinose. Eye-spot pigment present. Oral sucker 0.175 by 0.278, retractile into anterior end of body; anterior end thrown into rim-like circular fold provided with spines, most of them lost. Acetabulum 0.22-0.231 in diameter, spherical, near anterior extremity. Sucker ratio 1:1. Prepharynx short; pharynx 0.099 by 0.143, globular; cecal bifurcation in front of acetabulum; extent of ceca undetermined due to overlapping by vitellaria and voluminous uterus. Testes 0.4-0.424 by 0.294-0.306, symmetrical, entire, postequatorial. Cirrus sac absent. Seminal vesicle saccular, posterodorsal to acetabulum; pars prostatica long; prostatic gland cells well developed. Genital opening immediately anterior to acetabulum. Ovary consisting of large number of follicles, median, pretesticular, between vitellaria. Seminal receptacle large, saccular, anterodorsal to ovary. Laurer's canal not observed. Vitellaria follicular, in dorsolateral fields of middle one third of body meeting dorsomedially, from behind acetabulum to middle of testes. Uterus voluminous, between acetabulum and posterior extremity; metraterm undifferentiated. Eggs 15-18 x 9-11 μ. Excretory vesicle undetermined.

Host: Lutianus johnii (Bloch)

Site: Intestine

Locality: Karwar

In having a retractile oral sucker and in the structure of the anterior end of body, this species comes close to Metadena globossa (Linton, 1910), Metadena adglobossa Manter, 1947 and Metadena leilae Nagaty, 1957. However, it is distinct from all three in sucker ratio, lobation of the ovary and the extent and distribution of vitellaria.

The following trematode resembles Metadena Linton, 1910 and Pseudometadena Yamaguti, 1952 in many details but differs from them chiefly in the extent and distribution of vitellaria and in the possession of a trilobed instead of a multilobed ovary. It further differs from Pseudometadena in having testes far behind acetabulum and a distinctly pretesticular ovary. These differences warrant the erection of a new genus for which the name Neometadena is proposed

NEOMETADENA n. gen.

Diagnosis: Body oval. Cuticle probably unarmed. Cervical glands present. Oral sucker terminal. Acetabulum near anterior end of body. Mouth subterminal;

prepharynx indistinct; pharynx large; esophagus short; ceca wide, reaching posterior end of body. Testes postequatorial, intercecal. Cirrus sac absent. Seminal vesicle long, tubular, dorsal and posterior to acetabulum. Pars prostatica and prostatic complex absent. Genital pore in front of acetabulum. Ovary trilobed, median, equatorial, pretesticular. Seminal receptacle present. Vitellaria in lateral fields, from postacetabular to middle of posttesticular space. Uterus voluminous filling most of hindbody. Eggs thick-shelled. Excretory vesicle not observed.

Type species: Neometadena lutiani n. gen., n. sp.

Neometadena lutiani n. gen., n. sp.

Plate II, Figure 11

Description (Based on 2 specimens) Body 1.364-1.706 long, 0.847-0.959 wide, oval; cervical gland cells present; Cuticle aspinose. Eye-spot pigment present. Oral sucker 0.167-0.272 by 0.225-0.342, spherical, terminal. Acetabulum 0.19-0.23 by 0.202-0.296, spherical, near anterior extremity. Sucker ratio 1:0.81-1. Mouth subterminal; prepharynx indistinct; pharynx 0.131-0.152 by 0.173-0.252, subspherical; esophagus short; cecal bifurcation in front of acetabulum; ceca

wide, reaching posterior extremity. Testes 0.181-0.298 by 0.149-0.24, oval, entire, symmetrical, postequatorial Cirrus sac absent. Seminal vesicle long; convoluted, from behind acetabulum to pharyngeal level; pars prostatica and prostatic gland cells absent. Genital pore in front of acetabulum. Ovary consisting of three lobes, median, equatorial, pretesticular. Seminal receptacle anterior to ovary. Laurer's canal not observed. Vitellaria follicular, in lateral fields from behind acetabulum to middle of posttesticular region. Uterus voluminous, between acetabulum and posterior end; metraterm undifferentiated. Eggs 16-21 x 9-12 μ, very numerous, thick-shelled. Extretory vesicle undetermined.

Type Host: Lutianus johnii (Bloch)

Other Host: Lutianus fulviflamma (Forskål)

Site: Intestine

Type Locality: Karwar

Other Locality: Tuticorin

This species bears strange resemblance to Gupta's (1956) Steringophorus lethrini, a fellodistome from Lethrinus sp., from the Gulf of Mannar. The only apparent differences between the two are that the present species has cervical gland cells, eye-spot pigment and

does not possess a cirrus sac. These characters indicate its relationship to the Cryptogonimidae rather than the Fellodistomatidae.. It so appears that these characters have probably escaped Gupta's observations and led him to place it erroneously in the Fellodistomatidae. However, a request to borrow his specimens was denied.

Centrovarium marinum n. sp.

Plate III, Figure 12

Description (Based on 4 specimens): Body 1.364-1.811 long, 0.447-0.706 wide, more or less spindle-shaped. Cuticle aspinose. Eye-spot pigment present. Oral sucker 0.122-0.149 by 0.128-0.187, spherical, subterminal, larger than acetabulum. Acetabulum 0.068-0.087 in diameter, spherical, sunk in parenchyma, at about 0.447-0.6 from anterior end. Sucker ratio 1:0.5. Prepharynx 0.038-0.084 long; pharynx 0.073-0.096 by 0.09-0.116, globular, muscular; esophagus short, followed by cecal bifurcation; extent of ceca not traceable due to voluminous uterus. Testes 0.175-0.318 by 0.122-0.176, oval, symmetrical or slightly diagonal, lateral, postequatorial. Cirrus sac absent. Seminal vesicle saccular, bipartite, posterodorsal to ovary;

prostatic complex and cirrus probably absent. Genital pore preacetabular. Ovary divided into many follicles or lobes, median, almost equatorial. Laurer's canal not observed. Seminal receptacle anterodorsal to ovary. Vitellaria of small follicles, dorsolateral, not confluent medially, between cecal bifurcation and testes. Uterus voluminous, between acetabulum and posterior extremity. Eggs 13-19 x 9 μ, operculate. Excretory vesicle Y-shaped, arms reaching level of pharynx.

Host: Lutianus fulviflamma (Forskål)

Site: Intestine

Locality: Tuticorin

The type species Centrovarium lobotes (MacCallum, 1895) is a parasite of fresh water fishes. C. marinum n. sp. has been collected from a marine snapper. It differs from the former mainly in the sucker ratio and position of the bipartite seminal vesicle.

Family Monascidae Travassos et al, 1965

Monascus typicus (Odhner, 1911)

Plate III, Figure 13

Host: Decapterus russelli (Rüppell).

Site: Intestine

Locality: Cochin**

It varies from that redescribed by Fischthal and Kuntz (1963) in smaller body size (1.38-3.156 by 0.224-0.312), smaller ratio of forebody and hindbody (1:2), postequatorial position of ovary and absence of a spermatophore.

Family Fellodistomatidae (Nicoll, 1913)

The fluke described below is similar to Paradiscogaster Yamaguti, 1934 in body shape and topography of the internal organs but differs from it in the possession of a pair of lancet-like cuticular spines projecting out of the mouth opening and curving over the ventral surface of the oral sucker. Such a structure is quite unusual in the family Fellodistomatidae and appears to be characteristic of the present trematode, Moreover, it has a more elongate forebody, oval oral sucker and a large, muscular and protrusible cirrus. To accommodate this trematode, a new genus

Calitrema is proposed. The name refers to the locality, from where the worms were collected.

CALITREMA n. gen.

Diagnosis: Discogasteroidinae. Body elongate, pear-shaped with a tail cone. Cuticle probably spinose. Acetabulum large, discoid. Oral sucker oval, with a pair of lancet-like spines projecting out of mouth opening and curving over its ventral surface. Prepharynx, pharynx present; esophagus very long; ceca short, club-shaped. Testes symmetrical, posterior or posterodorsal to acetabulum. Cirrus sac elongate, enclosing usually bipartite seminal vesicle, a pars prostatica, prostatic gland cells and a large muscular cirrus. Genital opening postbifurcal. Ovary globular, dorsal to acetabulum. Seminal receptacle present. Vitellaria follicular, in two lateral groups, anterodorsal to acetabulum. Uterus voluminous, filling posterior part of body. Eggs thick-shelled. Excretory vesicle not observed. Intestinal parasites of marine fishes.

Type species: C. bispinata n. gen., n. sp.

Calitrema bispinata n. gen., n. sp.

Plate III, Figures 14, 15

Description (Based on 4 specimens): Body 0.756-1.692 long, 0.312-0.432 wide, elongate pear-shaped,

anterior end rounded, posterior end produced into a tail cone. Cuticular spines probably lost in processing. Acetabulum 0.263-0.427 in diameter, discoid, covering almost whole of posterior half of body. Oral sucker 0.119-0.194 by 0.089-0.122, oval, subterminal, a pair of lancet-like spines projecting out of oral opening and curving over its ventral surface. Prepharynx short; pharynx 0.024-0.039 by 0.033-0.042, globular; esophagus 0.116-0.36 long; cecal bifurcation 0.268-0.552 from anterior extremity; ceca short, club-shaped. Testes 0.069-0.098 in diameter, globular, entire, symmetrical or subsymmetrical, posterodorsal to acetabulum. Cirrus sac elongate, anterodorsal to acetabulum, containing usually a bipartite seminal vesicle occasionally unipartite, a long pars prostatica, numerous prostatic gland cells and a large, muscular, protrusible cirrus. Genital pore postbifurcal. Ovary 0.069-0.078 in diameter, globular, median or submedian, dorsal to acetabulum, pretesticular. Seminal receptacle posterior to ovary. Vitellaria follicular, in two lateral groups anterodorsal to acetabulum. Uterus voluminous, filling posterior part of body; metraterm undifferentiated. Eggs 24-33 x 15 μ. Excretory vesicle not observed.

Host: Drepane punctata (L.)

Site: Intestine

Locality: Bombay**

Bacciger nicolli Palombi, 1934

Plate III, Figure 16

Host: Clupea fimbriata* (= Ilisha f.) (Cuv. and Val.)

Site: Intestine

Locality: Bombay**

Bacciger cochinensis n. sp.

Plate III, Figure 17

Description (Based on 2 specimens): Body 1.118-1.188 long, 0.612-0.694 wide, ovate. Cuticle thin, aspinose. Eye-spot pigment absent. Acetabulum 0.078-0.087 in diameter, spherical, feeble, at 0.376-0.388 from anterior end. Oral sucker 0.078-0.116, subspherical, terminal or slightly subterminal, larger than acetabulum. Sucker ratio 1: 0.84. Prepharynx short; pharynx 0.047-0.053 by 0.053-0.059, globular, muscular; esophagus about 0.205 long; cecal bifurcation at about 0.33 from anterior end; ceca reaching short of testes. Testes 0.146-0.22 by 0.122-0.175, entire; oval or subspherical, symmetrical or subsymmetrical, postacetabular. Cirrus

sac ovoid, drawn into a neck, between pharynx and acetabulum, in type specimen pushed to right of median line, enclosing a saccular unipartite seminal vesicle, a tubular pars prostatica, diffused prostatic cells and ejaculatory duct. Genital pore anterior to middle of esophagus, submedian. Ovary 0.111-0.116 by 0.099-0.102, subglobular, entire, median, almost equatorial, pretesticular. Seminal receptacle dorsal to ovary and right testis. Laurer's canal not seen. Vitellaria in two lateral bunches, each comprising of 6 large follicles, in cecal zone; vitelline reservoir dorsal to ovary. Uterus voluminous, filling whole of posterior part of body; metraterm undifferentiated. Eggs 22-29 x 15-22 μ. thick-shelled, very numerous. Excretory vesicle Y-shaped, arms wide, reaching midlevel of esophagus.

Host: Thrissocles mystax (Bl. and Schn.)

Site: Intestine

Locality: Cochin

There are three valid species in the genus Bacciger Nicoll, 1914, B. bacciger (Rudolphi, 1819) Nicoll, 1914 B. nicolli Palombi, 1934 and B. opisthonemae Nahhas and Cable, 1964. B. cochinensis n. sp., is distinct from all three species in having a longer esophagus, shorter ceca, sucker ratio and prebifurcal cirrus sac. It

further differs from B. nicolli in having an entire ovary.

The next fellodistome comes close to Bacciger Nicoll, 1914 and Pseudobacciger Mahhas and Cable, 1964 in many respects but is distinct from both in possessing a spherical uterine dilatation filled with sperms, at the distal end of the uterus, a short but highly muscular metraterm following the dilatation, and an ovary unusual in position and comprising of three large spherical lobes. This worm forms a new genus Allobacciger which is defined as follows:

ALLOBACCIGER n. gen.

Diagnosis: Body ovate. Cuticle aspinose. Eye-spot pigment absent. Acetabulum spherical, terminal or subterminal, larger than acetabulum. Prepharynx present; pharynx small, globular; esophagus present; ceca? Testes quite large, lateral, symmetrical, equatorial. Cirrus sac pyriform, anterodorsal to acetabulum, postbifurcal, containing seminal vesicle, pars prostatica, prostatic gland cells and protrusible cirrus. Genital pore postbifurcal, median or submedian. Ovary comprising of three large spherical lobes. lateral, anterodorsal to right testis. Seminal receptacle probably absent. Vitellaria in two lateral clusters of

large follicles, extracecal, in forebody. Uterus voluminous, filling most of hindbody, anteriorly reaching level of cecal bifurcation or esophagus on left side only; distal end dilated into a sac filled with sperms and followed by a short but highly muscular metraterm. Eggs thick-shelled. Excretory vesicle undetermined; excretory pore terminal. Parasites of marine fish.

Type species: Allobacciger macrorchis n. gen., n. sp.

Allobacciger macrorchis n. gen., n. sp.

Plate IV, Figure 18

Description (Based on 4 specimens with measurements on 3): Body 0.753-0.78 long, 0.518-0.588 wide at equatorial level, ovate. Cuticle most probably spinose but spines lost during processing. Eye-spot pigment absent. Acetabulum 0.07-0.075 in diameter, spherical, feeble, at 0.294-0.318 from anterior end. Oral sucker 0.096-0.108 in diameter, spherical, subterminal or terminal, larger than oral sucker. Sucker ratio 1:0.68-0.73. Prepharynx 0.009-0.015 long; pharynx 0.035-0.038 in diameter, spherical, muscular; esophagus short, followed by cecal bifurcation; ceca presumably short. Testes 0.175-0.249 by 0.128-0.22, globular or oval, lateral, symmetrical,

equatorial. Cirrus sac 0.14-0.175 by 0.073-0.102 pyriform, posterior end slightly overlapped by acetabulum, distal part slightly bent towards left, enclosing a pyriform, unipartite seminal vesicle, a short pars prostatica, diffused prostatic gland cells, and a long, muscular, protrusible cirrus. Genital pore median or submedian, postbifurcal. Ovary comprising of 3 large, spherical lobes, lateral, anterodorsal to right testis. Seminal receptacle and Laurer's canal not observed. Vitellaria in two lateral clusters of large follicles, in forebody, extracecal, reaching level of posterior border of oral sucker; vitelline reservoir posterodorsal to acetabulum. Uterus voluminous, filling most of hind body, reaching anteriorly to level of esophagus on left side only; distal part dilated into a sac filled with sperms, followed by a short but highly muscular metraterm. Eggs very numerous, thick-shelled 15-21 x 12 μ. Excretory vesicle not seen; excretory pore terminal.

Host: Scolopsis vosmeri (Bloch)

Site: Intestine

Locality: Calicut

Faustula gangetica (Srivastava, 1935) Yamaguti, 1958

Plate IV, Figure 19

Host: Clupea toli* Cuv. and Val.

Site: Intestine

Localities: Bombay** and Veraval**

Srivastava (1935) described this form along with three other species of Orientophorus (Faustula Poche, 1926) from a "fresh-water fish, Clupea ilisha", which is in actual fact an anadromus species. It is a migratory marine form which ascends rivers in order to deposit their ova in suitable spots. According to Day (1958) this fish has been taken as high as Delhi, approximately a thousand miles away from the sea. Its occurrence in Clupea toli which does not appear to ascend rivers and breed like C. ilisha, is further proof that Faustula is primarily a genus occurring in marine fish.

Faustula basiri+ n. sp.

Plate IV, Figure 20

Description (Based on 5 specimens): Body 2.136-2.58 long, 1.032-1.104 wide at level of acetabulum, oval.

+ Named after Late Prof. M.A. Basir, Head, Deptt. of Zoology, Aligarh Muslim University, Aligarh.

Cuticle thick with spines on entire body. Acetabulum 0.203-0.28 by 0.195-0.245, subspherical, between testes; at 0.912-1.158 from anterior extremity, almost equatorial. Oral sucker 0.143-0.161 by 0.2-0.243, subglobular, terminal. Sucker ratio 1:1.1. Prepharynx short; pharynx 0.14-0.164 by 0.104-0.135, muscular; esophagus 0.24-0.456 long; cecal bifurcation at 0.54-0.66 from anterior extremity; ceca simple, arcuate, reaching about middle of ovary. Testes 0.2-0.3 by 0.12-0.18, oval, symmetrical, on either side of acetabulum, intercecal. Cirrus sac 0.408-0.528 by 0.264-0.288, pyriform with distal end reflexed backwards, between cecal arch and acetabulum, containing elongated S-shaped seminal vesicle, pars prostatica, ejaculatory duct and cirrus, filled with well-developed prostatic gland cells. Genital opening immediately postbifurcal. Ovary deeply multilobed, postacetabular, slightly sinistral. Seminal receptacle absent. Uterine seminal receptacle present. Laurer's canal present. Vitellaria follicular, lateral, extracecal between midesophageal level to level of middle of ovary, partly overlapped by uterine coils; yolk reservoir present behind acetabulum. Uterus voluminous, filling posterior half of body; reaching short of posterior extremity, partly overlapping ceca,

ovary, testes, vitellaria and shell gland; metraterm undifferentiated. Eggs 12-18 x 9-12 μ. Excretory vesicle Y-shaped with a short stem, and long arms reaching anterior to middle of esophagus; excretory pore terminal.

Host: Clupea toli Cuv. and Val.

Site: Intestine

Locality: Veraval

In having the cirrus sac anterior to acetabulum, the present species comes closest to Faustula clupeae[+] (Srivastava, 1935) Yamaguti, 1958 but differs from it in the larger size of the cirrus sac, length of esophagus, position of genital pore, extent of vitellaria and equatorial position of acetabulum.

The following trematode is similar to Antorchis Linton, 1911 in general appearance and other details. It is, however, very distinct from Antorchis in three main characters - (i) preacetabular ovary, (ii) rather straight cirrus sac (inverted U-shaped in Antorchis), (iii) posterior displacement of the acetabulum and as a result of (ii) and (iii) immediately postbifurcal genital

+ The ending in the specific name of F. clupii as given by Srivastava (1935) is not consistent with the International Rules of Zoological Nomenclature.

pore. To accommodate this trematode, a new genus Jonesiella[+] is here proposed.

JONESIELLA n. gen.

Diagnosis: Antorchinae. Body fusiform. Cuticle armed with spines. Acetabulum spherical or subspherical, feeble, in posterior part of body. Oral sucker spherical, subterminal. Prepharynx short; pharynx small, globular; esophagus long; ceca short, saccular club-shaped. Testes symmetrical, posterior to cecal ends, preacetabular. Cirrus sac elongate, straight, containing bipartite seminal vesicle, pars prostatica, prostatic gland cells, and cirrus. Genital opening submedian, postbifurcal. Ovary preacetabular, in post testicular zone. Seminal receptacle present, dorsolateral or dorsal to acetabulum. Laurer's canal present Vitellaria follicular in two lateral clusters or acini in front of esophageal zone. Uterus voluminous, filling posttesticular region of body. Excretory vesicle V-shaped with arms reaching cecal ends.

Type species: Jonesiella pomacanthi n.gen., n. s

+ Named after Dr. S. Jones, Director, Central Marine Fisheries Research Institute, Mandapam.

Jonesiella pomacanthi n. gen., n. sp.

Plate IV, Figure 21

Description (Based on 5 of several specimens): Body 1.428-1.764 long, 0.682-0.78 wide at acetabular level, roughly fusiform with rounded anterior and narrowing posterior end. Cuticle spinose, although most spines lost in processing. Acetabulum 0.143-0.218 in diameter, subspherical, in posterior half of body. Oral sucker 0.152-0.18 in diameter, spherical, subterminal. Sucker ratio 1:1. Prepharynx short; pharynx 0.048-0.06 by 0.069-0.075, globular, muscular; esophagus 0.36-0.492 long; ceca club-shaped, short, reaching testes or slightly overlapping them. Testes 0.142-0.194 by 0.11-0.156, spherical or oval, symmetrical, posterior to cecal ends preacetabular. Cirrus sac about 0.312-0.492 long, 0.120-0.168 wide, straight or slightly curved at distal end, containing bipartite seminal vesicle, long pars prostatica, well-developed prostatic gland cells, and cirrus. Genital atrium large. Genital pore postbifurcal, median, or to right of median line. Ovary 0.09-0.119 in diameter, spherical, preacetabular, in testicular zone, posterior to or between cirrus sac and left testis. Seminal receptacle large, round, dorsal or anterolateral to acetabulum. Laurer's canal present,

opening dorsally somewhere posterior to acetabulum. Vitellaria follicular, in 2 lateral clusters, from midesophageal level to ceca, mainly extraceca, occasionally overlapping them partially; vitelline reservoir posterior to ovary. Uterus voluminous, filling almost whole of posttesticular space. Eggs thick-shelled, very numerous, 29-45 x 15-19 μ. Excretory vesicle V-shaped, arms reaching cecal ends; excretory pore terminal.

Host: Pomacanthus annularis (Bloch)

Site: Intestine

Locality: Waltair (Lawson's Bay)

Tergestia laticollis (Rud., 1819) Stossich, 1899

Plate V, Figure 22

Host: Hemiramphus far* (Forskål)

Site: Intestine

Locality: Mandapam**

The next trematode is distinguishable from all the existing fellodistomatid genera in general and members of the sub-family Discogasteroidinae in particular in possessing large spines on the cirrus. In most other details it resembles Calitrema n. gen., from which, however, it differs in the absence of a pair of lancet-like oral spines and in having the ventral lip of oral

sucker deeply incised. For the reception of this trematode a new genus Paracalitrema is erected. Although the presence of well developed spines on the cirrus warrants the erection of a new subfamily, this new genus is included under Discogasteroidinae because of the characteristic disc-like acetabulum.

PARACALITREMA n. gen.

Diagnosis: Discogasteroidinae. Body elongate pear-shaped, posterior end produced into a tail cone. Cuticle spinose. Acetabulum large, disc-like, emarginate. Oral sucker ovate, subterminal, mouth opening lotus-like. Prepharynx short; pharynx small; esophagus long; ceca short, saccular. Testes symmetrical or subsymmetrical, postacetabular. Cirrus sac elongate, obliquely oriented, containing bipartite seminal vesicle, large pars prostatica and large protrusible cirrus beset with large spines. Genital opening postbifurcal, submedian to right. Ovary postacetabular, pretesticular, anterodorsal to left testis. Seminal receptacle large, postovarian. Laurer's canal present. Vitellaria follicular, in two lateral groups, postcecal, anterolateral to acetabulum; vitelline reservoir present. Uterus voluminous, in hind body. Eggs thick-shelled. Excretory vesicle not observed.

Type species: Paracalitrema acanthocirrus n. gen., n. sp.

Paracalitrema acanthocirrus n. gen., n. sp.

Plate V, Figure 23

Description (Based on 5 of 9 specimens): Body 1.968-2.226 long, 0.72-0.804 wide at acetabular level, elongate pear-shaped, anterior end rounded, posterior extremity produced into a tail cone. Cuticle with spines all over body, arranged in oblique rows. Acetabulum 0.456-0.48 by 0.576-0.636, discoid with anterior posterior and lateral depressions, with its centre postequatorial. Oral sucker 0.262-0.291 by 0.206-0.221, oval, subterminal. Prepharynx short; pharynx 0.06-0.078 in diameter, globular, muscular; esophagus 0.324-0.468 long; cecal bifurcation at 0.672-0.864 from anterior extremity; ceca short, club-shaped. Testes 0.128-0.209 by 0.094-0.143, oval or globular, symmetrical or subsymmetrical, postacetabular, lateral, in a paratype right testis pushed by uterus to posterior end of body while in another paratype right testis anterior most. Cirrus sac large, fusiform, oriented obliquely between acetabular disc and right cecal arch, anterior part reflected backward, posterior part slightly overlapped by acetabulum, containing bipartite seminal vesicle in

its posterior part, a long pars prostatica, well developed prostatic gland cells and large protrusible cirrus with large spines on it. Genital pore slightly preacetabular, submedian to right, at level of posterior end of ceca. Ovary 0.081-0.125 in diameter, globular, entire, left of median line, pretesticular, posterior or posterodorsal to acetabulum. Seminal receptacle 0.084-0.134 in diameter, oval or globular, immediately postovarian, between testes. Laurer's canal present, opening dorsally between testes. Vitellaria follicular (or acinous), in two clusters, from level of cecal ends to anterior level of acetabulum; vitelline reservoir dextral to ovary. Uterus voluminous, filling almost whole of postacetabular space; metraterm undifferentiated Eggs thick-shelled, numerous, 25-33 x 15 μ. Excretory vesicle not seen; excretory pore terminal.

Host: Drepane puntata (L.)

Site: Intestine

Locality: Veraval

The separation of the genera of Discogasteroidinae is based mainly on the extent of the vitellaria. The present worm is similar to Paradiscogaster Yamaguti, 1934 in general morphology and topography of the gonads,

but differs only in the nature and extent of vitellaria. Erection of a new genus on the basis of this character alone is not justified and thus it is here described as a new species under Paradiscogaster. The latter can still be distinguished from Discogasteroides in having a very long esophagus.

Paradiscogaster farooqii[+] n. sp.

Plate V, Figure 24

Description (Based on 3 specimens): Body 1.686-1.806 long, 0.456-0.54 wide at ovarian level, fusiform with rounded extremities. Cuticle spinose although spines lost during processing. Acetabulum 0.253-0.372 by 0.239-0.324, discoid with anterior, posterior and lateral concavities, in middle third of body. Oral sucker 0.113-0.128 by 0.123-0.141, spherical, terminal. Prepharynx short; pharynx 0.036-0.045 by 0.051-0.066, globular; esophagus 0.396-0.42 long; cecal bifurcation at 0.54-0.6 from anterior extremity; ceca short, saccular, club-shaped. Testes 0.104-0.149 by 0.069-0.098, oval or spherical, symmetrical or subsymmetrical,

---

+ Named after Mr. Hisam U. Farooqi, Deptt. of Zoology, Aligarh Muslim University, Aligarh.

postero-lateral to acetabular disc. Cirrus sac elongate, distal end slightly curved to right, between cecal bifurcation and acetabular disc, containing bipartite seminal vesicle, long pars prostatica and protrusible cirrus, mostly filled with prostatic gland cells. Genital pore postbifurcal, median or submedian. Ovary 0.078-0.104 in diameter, globular, posterosinistral to acetabular disc, pretesticular. Seminal receptacle large, spherical, immediately postovarian, between testes. Laurer's canal opening dorsally in front of posterior extremity. Vitellaria acinous, lateral, sparsely distributed from level of cecal bifurcation to ovary. Uterus voluminous filling whole of posterior part of body; metraterm undifferentiated. Eggs 27-31 x 15-18 μ, thick-shelled, numerous. Excretory vesicle not observed.

Host: Scatophagus argus (L.)

Site: Intestine

Locality: Tuticorin

Paradiscogaster has two species, P. pyriformis, Yamaguti, 1934 and P. chaetodontis Yamaguti, 1938. P. farooqii n. sp., differs from both of them mainly in the nature, sparse distribution and extent of vitellaria.

Family Opistholebetidae Fukui, 1929

Opistholebes cotylophorus Ozaki, 1935

Plate V, Figure 25

Host: Tetrodon lunaris* Bl. and Schn.

Site: Intestine

Locality: Madras**

A single specimen was collected and it appears that lateral margins have folded over to give it a pyriform shape..

Opistholebes amplicoelus Nicoll, 1915

Plate V, Figure 26

Host: Tetrodon lunaris Bl. and Schn.

Site: Intestine

Locality: Madras**

The trematode described below belongs to the family Opistholebetidae and in having testes posterior to acetabulum, it is similar to Heterolebes Ozaki, 1935 but differs from it in the possession of two acetabula, one within the larger one, just like in the opecoelid Allodecemtestis n. gen. As this character is not found in any other opistholebetid, a new genus is erected for the reception of this trematode.

TETRODONICOLA n. gen.

Diagnosis: Body oblong. Unarmed. Acetabula two, concentrically constructed, postequatorial. Oral sucker with a muscular postoral ring; esophagus short; ceca simple, reaching short of posterior extremity. Testes entire, oval or kidney shaped, posterolateral to acetabulum, occasionally overlapping posterolateral margin of acetabulum. Cirrus sac fusiform, between cecal arch and acetabulum, containing coiled seminal vesicle, a short pars prostatica surrounded by glandular cells and an ejaculatory duct. Genital pore postbifurcal. Ovary spherical, posterodorsal or anterodorsal to acetabulum, submedian. Seminal receptacle present. Shell gland and Laurer's canal present. Vitellaria follicular, from cecal bifurcation to posterior extremity, confluent in pre- and postacetabular region Uterus pretesticular; metraterm present. Eggs thin-shelled. Excretory vesicle probably tubular. Intestinal parasites of marine fishes.

Type species: Tetrodonicola biacetabulata n. gen., n. sp.

Tetrodonicola biacetabulata n. gen., n. sp.

Plate VI, Figures 27, 28

Description (Based on one of six specimens from Tetrodon lunaris and two of nine specimens from Tetrodon oblongus): Body 2.27-4.763 long, 0.93-1.811 wide at acetabular level, oblong. Cuticle unarmed. Acetabula two, concentrically constructed, quite large and prominent, in postequatorial region. Oral sucker 0.287-0.482 by 0.263-0.612, spherical or globular, subterminal. A muscular postoral ring present. Prepharynx short; pharynx 0.199-0.376 by 0.266-0.588, globular, muscular; esophagus short; ceca simple, quite wide, reaching short of posterior extremity. Testes 0.199-0.506 by 0.116-0.353, oval or kidney shaped, posterolateral to acetabulum, occasionally overlapping posterolateral margins of latter. Cirrus sac fusiform, between cecal arch and acetabulum, containing a much convoluted tubular seminal vesicle, a short pars prostatica surrounded by gland cells, and an ejaculatory duct. Genital pore postbifurcal. Ovary 0.122-0.353 by 0.152-212, spherical or globular, posterodorsal to acetabulum, pretesticular, occasionally dorsal, anterodorsal or anterior to acetabulum depending on pressure applied while fixing. Seminal receptacle present. Laurer's

canal present. Vitellaria follicular, from cecal bifurcation to posterior extremity, confluent in pre- and postacetabular region. Uterus pretesticular, proximal coils occasionally filled with sperm cells; metraterm present. Eggs (from unmounted specimens) 68-73 x 44-56 μ, thin-shelled. Excretory vesicle probably tubular; excretory pore terminal.

Type Host: Tetrodon lunaris Bl. and Schn.

Other Host: Tetrodon oblongus Bloch

Type Locality: Bombay

Other Locality: Madras

Family Lepocreadiidae Nicoll, 1934

Aephnidiogenes senegalensis Dollfus and Capron, 1958

Plate VI, Figure 29

Host: *Pomadasys maculatus** (Bloch)

Site: Intestine

Locality: Veraval**

Lepocreadioides indicum Srivastava, 1941

Plate VI, Figure 30

Hosts: *Cynoglossus bilineatus** (Bloch);

*C. dubius** Day; *C. lida** (Bloch) *C. lingna** Hamilton Buchanan, *C. macrolepidotus* (Bleeker) *C. puncticeps** (Rechardson) and *C. sindensis** Day.

Srivastava (1941) collected this species from *Platycephalus insidiator* from Puri and Karachi. Though the author did not record it from the type host, it is a very common trematode inhabiting the intestine of various species of *Cynoglossus* Hamilton-Buchanan occuring along the east and west coasts of India.

The lepocreadiid to be described below is distinguishable from all other genera of the family in body shape and in the number and arrangement of testes. Therefore, a new genus Transversocreadium is here proposed for its reception.

TRANSVERSOCREADIUM n. gen.

Diagnosis: Body transversely elongated with a short tail-cone. Cuticle smooth, unarmed. Acetabulum spherical, median. Oral sucker terminal, spherical. Prepharynx indistinct; pharynx present; oesophagus short; ceca arcuate, ending blindly. Testes ten, five on each side of acetabulum arranged horizontally in series. Cirrus sac club-shaped, enclosing internal seminal vesicle, prostatic complex and cirrus. External seminal vesicle present. Genital pore at bottom of a notch on left of oral sucker, marginal. Ovary lobed. Seminal receptacle present. Uterus in centre of body; metraterm present. Eggs thin-shelled. Excretory vesicle tubular with a posterior vesicle in tail-cone.

Type and only species: Transversocreadium cablei+ n. gen., n. sp.

+ Named after Professor R.M. Cable.

Transversocreadium cablei n. gen., n. sp.

Plate VI, Figure 31

Description (Based on 5 specimens): Body 0.47-0.647 long, 1.118-1.576 wide, transversely elongated with a short tail-cone. Cuticle unarmed, smooth. Acetabulum 0.059-0.075 in diameter, spherical, feeble, in centre of body. Oral sucker 0.051-0.068 in diameter, terminal, feeble. Sucker ratio 1:1.11-1.4. Prepharynx indistinct; pharynx 0.044-0.053 in diameter, muscular; esophagus short; ceca arcuate, ending blindly near posterior extremity. Testes 0.116-0.175 by 0.059-0.096, ten, five on either side of acetabulum, arranged horizontally. Cirrus sac club-shaped, disposed obliquely from right to left, extending posteriorly to about midlevel of acetabulum, enclosing internal seminal vesicle in swollen base, prostatic complex and cirrus in neck. External seminal vesicle present. Genital pore marginal, situated at bottom of a notch left to oral sucker. Ovary deeply lobed, anterosinistral, sinistral or posterosinistral to acetabulum. Seminal receptacle large, saccular, near ovary. Vitellaria follicular, disposed along course of ceca, confluent posteriorly. Uterus between ovary and genital pore; metraterm present. Eggs collapsed, measuring 41-62 x 27-41 μ, thin-walled. Excretory

vesicle tubular with a posterior vesicle in tail-cone; excretory pore terminal.

Host: Triacanthus brevirostris Schlegel

Site: Intestine

Type locality: Calicut

Other locality: Tuticorin

Crassicutis karwarensis n. sp.

Plate VI, Figure 32

Description (Based on 8 of 20 specimens): Body 1.292-3.024 long, 0.372-0.984 wide, elongate with rounded posterior and slightly narrowing anterior extremity. Cuticle thick, spines not observed. Eye-spot pigment present. Acetabulum 0.215-0.36 in diameter, spherical, preequatorial, at 0.438-1.116 from anterior end. Oral sucker 0.143-0.295 in diameter, spherical, subterminal. Sucker ratio 1:1.23-1.68. Prepharynx 0.024-0.095 long; pharynx 0.072-0.134 by 0.08-0.158, globular; esophagus short followed by cecal bifurcation; ceca simple, reaching posterior extremity. Testes 0.161-0.534 by 0.155-0.396, entire, tandem, in posterior half of body. Cirrus sac absent; seminal vesicle 0.224-0.323 by 0.051-0.168, sac like posterosinistral and dorsal to acetabulum ejaculatory duct curving along anterior margin of acetabulum. Genital

pore median, in front of acetabulum. Ovary 0.091-0.14 by 0.09-0.188, subglobular, entire, submedian to right, between anterior testis and acetabulum. Seminal receptacle club-shaped, dorsal to ovary between anterior testis and acetabulum, occasionaly tubular. Laurer's canal present. Vitellaria consisting of large follicles always from level of cecal bifurcation to posterior end of body, confluent in preacetabular and posttesticular regions, overlapping ceca ventrally and dorsally. Uterus not observed in any specimen. Only one collapsed egg measuring 81 x 57 μ. Excretory vesicle not observed.

Host: Gerres filamentosus Cuv. and Val.

Site: Intestine

Locality: Karwar

Crassicutis karwarensis n. sp., comes closest to C. marina Manter, 1947 described from a closely related host species at Tortugas, Florida, but differs from it in the anterior extent of vitelline follicles (in C. marina it extends up to posterior half of oral sucker).

Diploproctodaeun plicitum (Linton, 1928) Sogandares & Hutton, 1958

Plate VII, Figures 33,34

Hosts: Tetrodon lunaris* Bl. and Schn.
Gastrophysus spadiceus* (Richardson)

Site: Intestine

Localities: Madras** and Visakhapatnum** respectively

In addition to what Manter (1947) pointed out, the following variations have been observed in 20 specimens (1) the posterior testis is unlobed; (2) the vitellaria extend up to the level of anterior margin of acetabulum; (3) the genital pore is more anterolateral to acetabulum; (4) the pharynx is large and is almost equal to acetabum.

Diploproctodaeum anteroporum n. sp.

Plate VII, Figure 35

Description (Based on 5 of 17 specimens): Body 1.56-2.328 long, 0.936-1.272 wide in cephalic region, oblong, lateral expansions curved and fused ventrally behind acetabulum, forebody with gland cells. Cuticle thin with fine spines in anterior part of body. Eye-spot pigment present. Acetabulum 0.188-0.288 by 0.206-0.324, spherical, feeble, preequatorial, at 0.564-0.792 from anterior extremity. Oral sucker 0.209-0.324 by 0.236-0.348, squarish, subterminal. Oral lobe 0.084-0.122 wide. Sucker ratio 1:0.87-1. Prepharynx absent;

pharynx 0.17-0.264 by 0.209-0.312, anterior border notched into 8 lobes, esophagus very short; intestinal bifurcation anterior to acetabulum; ceca simple, opening at ani on either side of excretory pore. Testes 0.179-0.378 by 0.152-0.324, subglobular or oval, diagonal with right one anterior-most, at junction of middle and posterior one third of body, immediately posterior to ovary. External seminal vesicle saccular, lying between cirrus sac anteriorly and ovary and seminal receptacle posteriorly. Cirrus sac club-shaped, extending dorsal to acetabulum between external seminal vesicle and genital pore, left of midline, enclosing internal seminal vesicle in swollen base and prostatic complex in neck. Cirrus tubular, sometimes projecting out of genital pore. Genital pore sinistral to base of pharynx. Ovary lobed, irregular in outline, between anterior testes and external seminal vesicle. Seminal receptacle saccular, posterolateral to ovary, between external seminal vesicle and posterior testes. Shell gland present. Vitellaria follicular, from postpharyngeal level to posterior extremity, confluent posterior to testes. Uterus scanty, between ovary and cirrus sac Metraterm thick-walled, stout, long, on left of cirrus sac. Eggs (from unmounted specimens) 66-87 x 45-75 μ.

Excretory vesicle tubular; extent not observed; pore terminal.

Host: Tetrodon oblongus Bloch

Site: Intestine

Locality: Madras

There are 8 species in the genus Diploproctodaeum LaRue, 1926: D. haustrum (McCallum, 1918) LaRue, 1926; D. cryptosoma (Ozaki, 1928) Sogandares and Hutton, 1958; D. plicitum (Linton, 1928) Sogandares and Hutton, 1958; D. hemistoma (Ozaki, 1928) Sogandares and Hutton, 1958; D. holocentri (Yamaguti, 1942) Songandares and Hutton 1958; D. tetrodontis (Nagaty, 1957) Sogandares and Hutton, 1959; D. vitellosum Sogandares and Hutton, 1959; and D. diodontis Nahhas and Cable, 1964.

In having the genital opening at the base of pharynx and in the absence of a prepharynx, D. anteroporum n. sp., comes close only to D. tetrodontis and in the possession of vitellaria extending up to post-pharyngeal level it is similar to D. holocentri and D. tetrodontis, but differs from the former mainly in the contour of the body, disposition of the cirrus sac, metraterm and sucker ratio; and from the latter it differs in the shape of body and preequatorial position of acetabulum. D. anteroporum differs from D. vitellosum

in body shape, extent of vitellaria (beyond base of oral sucker in D. vitellosum), absence of prepharynx, presence of a short esophagus, and similar size of the pharynx with respect to the sizes of oral sucker and acetabulum. From D. diodontis it differs chiefly in the shape of body and position of the ani. In having vitellaria up to the level of pharynx, D. anteroporum differs from D. plicitum, D. cryptosoma, D. hemistoma and D. haustrum. It further differs from D. haustrum in the contour of body, disposition of testes and length of esophagus. It differs from D. hemistoma in sucker ratio and in the absence of the prepharynx and smaller esophagus. D. cryptosoma is different in lobation (8 in D. anteroporum) of anteroventral margin of the pharynx.

KEY TO SPECIES OF DIPLOPROCTODAEUM LaRue, 1926

1. Anal openings at posterior end of body on either side of excretory pore 2

   Anal openings dorsal and well removed from posterior end of body D. diodontis

2. Vitellaria extending anterior to level of or a short distance beyond oral sucker..... D. vitellosum

   Vitellaria reaching level of pharynx.....3

Vitellaria not reaching level of pharynx 5

3. Genital opening sinistral to base of pharynx.....4

Genital opening at left posterior border of acetabulum ..... D. holocentri

4. Acetabulum at or slightly posterior to midbody level ..... D. tetrodontis

Acetabulum preequatorial.. D. anteroporum n.sp.

5. Body divided into an anterior spoon-shaped and posterior cylindrical or subcylindrical regions.....6

Body not divided into two such regions 7

6. Testes tandem; vitellaria not reaching acetabulum ..... D. haustrum

Testes diagonal; vitellaria reaching acetabulum ..... D. hemistoma

7. Cecal bifurcation removed from acetabulum ..... D. cryptostoma

Cecal bifurcation just anterior to acetabulum ..... D. plicitum

The general morphology of the trematode described below suggests that it is a member of the genus Diploproctodaeum LaRue, 1926. However, the absence of the two ani verified by serial sectioning the worm, the arrangement of the gonads, the terminal oral sucker and the extent of the uterus exclude it from that genus

and justify the erection of a new one for which the name Aproctodaeum is proposed.

The discovery of this new genus with no ani but resembling Diplcproctodaeum in all other details supports the suppression of Diploproctodaeidae Ozaki, 1928 and Dermadenidae Yamaguti, 1958 by Nahhas and Cable (1964) in favour of Lepocreadiidae Nicoll, 1934.

APROCTODAEUM n. gen.

Diagnosis: Body ovate or vase-shaped, aspinose. Eye-spot pigment present. Acetabulum preequatorial. Oral sucker terminal. Prepharynx present; pharynx globular, esophagus present, ceca simple, terminating blindly near lateral margin in posterior one third of body. Testes symmetrical, close to posterior extremity. External seminal vesicle present; cirrus sac club-shaped. Ovary median, postacetabular, pretesticular. Seminal receptacle present. Vitellaria follicular, between cecal bifurcation and posterior extremity. Uterus between ovary and testes; metraterm long and stout. Excretory vesicle up to ovary. Parasites of marine fishes.

Type species: Aproctodaeum ovatum n. gen., n. sp.

Aproctodaeum ovatum n. gen., n. sp.

Plate VII, Figures 36-38

Description (based on 5 of several specimens): Body 1.188-1.356 long, 0.96-1.296 wide, vase-shaped, formed by ventromedial fusion of lateral expansions with an expanded anterior cephalic region and a round posterior part, cephalic region with numerous gland cells. Cuticle thin, aspinose. Eye-spot pigment present. Acetabulum 0.122-0.155 in diameter, feeble almost preequatorial. Oral sucker 0.081-0.11 by 0.116-0.155, terminal. Sucker ratio 1:1.3. Prepharynx short; pharynx 0.069-0.116 in diameter; esophagus 1½ times that of pharynx followed by cecal bifurcation; ceca simple, terminating blindly near lateral margins at or near junction of middle and posterior one third of body. Testes 0.158-0.36 by 0.132-0.264 entire, close to posterior extremity, slightly diagonal or symmetrical. External seminal vesicle saccular, indistinct. Cirrus sac 0.3-0.384 by 0.11-0.132, club-shaped, disposed obliquely between cecal bifurcation and acetabulum; enclosing internal seminal vesicle in its swollen base and prostatic complex and muscular cirrus in its neck. Genital opening sinistral to cecal bifurcation. Ovary 0.132-0.206 by 0.122-0.192, median,

entire, occasionally slightly irregular in outline, postequatorial, postacetabular, forming a triangle with testes. Seminal receptacle saccular, large, lateral to acetabulum and ovary. Vitellaria follicular, extending from level of cecal bifurcation to posterior extremity, confluent posterior to testes and penetrating into folded lateral expansions of body. Uterus scanty, between testes and acetabulum; metraterm highly muscular and thick-walled, stout, long, anterolateral to acetabulum. Eggs 63-64 x 48-54 μ. Excretory vesicle tubular, up to ovary.

Host: Triacanthus brevirostris Schlegel

Site: Intestine

Locality: Calicut.

Lepidapedon manteri+ n. sp.

Plate VIII, Figure 39

Description (Based on 5 of 8 specimens): Body 1.28-2.836 long, 0.516-0.684 wide at testicular level, elongate, slightly narrowing anteriorly. Cuticle thick, spinose. Eye-spot pigment present. Acetabulum 0.107-0.147 in diameter, preequatorial, at 0.696-1.02 from anterior extremity. Oral sucker 0.093-0.134 by 0.113-0.158, globular, terminal or very slightly subterminal.

+ Named after Prof. H.W. Manter.

Sucker ratio 1:0.91-1. Prepharynx 0.036-0.119 long; pharynx 0.075-0.098 in diameter; esophagus 0.149-0.256, longer than prepharynx; ceca simple, not quite reaching posterior extremity. Testes 0.194-0.295 by 0.182-0.236, entire, diagonal with left one anterior most, in posterior one third of body. External seminal vesicle tubular, coiled, surrounded by a large number of gland cells enveloped in a thin membrane, postacetabular. Cirrus sac 0.194-0.247 by 0.072-0.125, spindle-shaped, thick-walled, enclosing internal seminal vesicle, entire prostatic complex, and cirrus, anterodorsal to acetabulum; internal seminal vesicle connected with external seminal vesicle through a narrow isthmus. Genital pore median, halfway between acetabulum and cecal bifurcation. Ovary 0.113-0.158 in diameter, globular, entire, median, pretesticular, postequatorial. Seminal receptacle not observed. Vitellaria follicular, from posterior level of esophagus to slightly short of posterior extremity. Uterus scanty, between ovary and cirrus sac; metraterm distinctly muscular, long, sinistral to cirrus sac, extending beyond genital pore and then recurving back to open at genital pore. Eggs few, 60-81 x 40-52 μ. Excretory vesicle a long and narrow tube passing between two testes and extending up to cecal bifurcation;

excretory pore terminal.

Host: Anthias multidens (Day)

Site: Intestine

Locality: Karwar

In having an excretory vesicle extending up to cecal bifurcation, and vitellaria beyond acetabulum, L. manteri n. sp., comes close to L. congeri Manter, 1954 but differs from it in the length of prepharynx and esophagus, in having diagonal testes, unlobed ovary and larger eggs and in the absence of a seminal receptacle.

Lepidapedon longivesiculum n. sp.

Plate VIII, Figure 40

Description (Based on 4 of several specimens): Body 1.035-0.882 long, 0.131-0.167 wide, elongate, narrow with rounded extremities. Cuticle thick with fine spines on entire body. Eye-spot pigment present. Acetabulum 0.047-0.059 in diameter, preequatorial, at 0.318-0.388 from anterior end. Oral sucker 0.051-0.065 in diameter, subterminal. Sucker ratio 1:0.9. Prepharynx 0.059-0.099 long; pharynx 0.04-0.047 in diameter; esophagus 0.059-0.116 long, almost equal to prepharynx; cecal bifurcation between acetabulum and pharynx; ceca simple, reaching short of posterior

extremity. Testes 0.08-0.1 in diameter, entire, tandem, in middle of posterior one third of body. Cirrus sac club-shaped, thick-walled, extending far behind acetabulum, occasionally up to ovary, enclosing internal seminal vesicle, pars prostatica with gland cells and cirrus. External seminal vesicle coiled, surrounded by gland cells enveloped in a thin membrane, connected with internal seminal vesicle through a narrow isthmus. Genital pore median, in front of acetabulum. Ovary 0.053-0.068 in diameter, postequatorial, between external seminal vesicle and anterior testis. Seminal receptacle spherical, anterior to anterior testis. Laurer's canal present. Vitellaria follicular, from level of cecal bifurcation to posterior extremity. Uterus scanty, preovarian; metraterm long, dorsal to acetabulum. Eggs large, few, 56-73 x 44-47 μ. Excretory vesicle tubular, reaching up to posterior level of pharynx; excretory pore terminal.

Host: Pampus argenteus (Euphrasen)

Site: Intestine

Locality: Bombay

Among the species of the genus Lepidapedon Staffard, 1904, in which excretory vesicle extends beyond cecal bifurcation, this species is distinctive

in having an excretory vesicle extending up to posterior level of pharynx. However, it comes close to L. hancocki Manter, 1940, L. nicolli Manter, 1934, L. truncatum Sogandares, 1959, L. congeri Manter, 1954 and L. manteri n. sp., in having vitellaria extending up to or beyond acetabulum, but differs from L. truncatum and L. congeri in having an unlobed ovary; from L. hancocki in the length of prepharynx and esophagus; from L. nicolli in having a genital pore anterior to acetabulum, and from L. manteri n. sp., in having tendem testes, and vitellaria not reaching beyond cecal bifurcation and in the size of prepharynx. The species name refers to the very long excretory vesicle.

KEY TO SPECIES OF LEPIDAPEDON Stafford, 1904

This key is a modified form of that provided by Srivastava (1966), thus incorporating the two new species described above.

1. Excretory vesicle extending beyond cecal bifurcation 2

   Excretory vesicle extending up to or near, but not beyond cecal bifurcation 3

   Excretory vesicle not reaching acetabulum 10

2. Vitellaria not reaching acetabulum. L. epinepheli+

   Vitellaria reaching cecal bifurcation ..... L. longivesiculum n. sp.

3. Lateral sucker present ..... L. trachinoti

   Lateral sucker absent 4

4. Vitellaria not reaching acetabulum 5

   Vitellaria extending up to or beyond acetabulum 6

5. Oral sucker smaller than acetabulum ..... L. parepinepheli

   Oral sucker larger than acetabulum ..... L. levenseni

6. Ovary lobed 7

   Ovary entire 8

7. Prepharynx long, testes tandem ..... L. congeri

   Prepharynx short, testes diagonal.. L. truncatum

8. Vitellaria extending up to cecal bifurcation ..... L. manteri n. sp.

   Vitellaria extending up to acetabulum only 9

9. External seminal vesicle reaching to or nearly reaching ovary ..... L. hancocki

   External seminal vesicle reaching halfway between acetabulum and ovary ..... L. nicolli

---

+ This species has been described to have excretory vesicle reaching cecal bifurcation but has been illustrated in the diagram to extend beyond that.

10. Vitellaria reaching mid-pharyngeal level ..... L. antarcticus

    Vitellaria reaching intestinal bifurcation ..... L. calli

    Vitellaria reaching acetabulum 11

    Vitellaria never reaching acetabulum 15

11. Male and female genital openings separate ..... L. luteum

    Genital opening common 12

12. Prepharynx almost equal to esophagus .....L. genge

    Prepharynx longer than esophagus 13

13. Genital pore at level of anterior border of acetabulum ..... L. cambrensis

    Genital pore far anterior to acetabulum 14

14. Vitellaria almost confluent between testes; posttesticular space 1/4th of body ..... L. lebouri

    Vitellaria not confluent between testes; posttesticular space 1/5th of body ..... L. rachion

15. Esophagus short, if present .....L. clavatum

    Esophagus distinctly long 16

16. Testes separate, vitellaria confluent between testes 17

    Testes contiguous, vitellaria not confluent between testes 18

17. Vitellaria extending across preovarian region .....L. gadi

Vitellaria not extending across preovarian region ..... L. elongatum

18. Oral sucker larger than acetabulum, eggs 36 μ wide ..... L. gymnocanthi

Oral sucker smaller than acetabulum, eggs 55-65 μ wide..... L. australis

Pseudocreadium patellare Yamaguti, 1938

Plate VIII, Figure 41

Host: Balistes capistratus* Shaw

Site: Intestine

Locality: Tuticorin**

Except for certain body measurements, shape of cirrus sac and slight difference in the position of genital opening, this worm agrees fairly with Yamaguti's (1938) description. These differences are regarded as variations.

Rhomboid body shape, posttesticular position of ovary, symmetrical testes in acetabular zone, marginal genital pore at level of oral sucker, are characters not found in any known lepocreadiid genus. Therefore, for the reception of the trematode described below, a new genus Rhombocreadium is erected.

RHOMBOCREADIUM n. gen.

Diagnosis: Body rhomboid in shape. Eye-spot pigment present. Acetabulum median, equatorial, Oral sucker terminal or subterminal. Prepharynx, pharynx and esophagus present; ceca simple, extending to posterior extremity. Testes two, symmetrical, on either side of acetabulum, preovarian; Cirrus sac club shaped, containing internal seminal vesicle and prostatic complex; external seminal vesicle saccular. Genital pore marginal, near oral sucker. Ovary lobed, median, posttesticular, postacetabulur. Seminal receptacle present. Vitellaria follicular. Uterus scanty, metraterm distinct. Excretory vesicle tubular, up to ovary. Parasites of marine fishes.

Type and only species: Rhombocreadium symmetrorchis n. gen., n. sp.

Rhombocreadium symmetrorchis n. gen., n. sp.

Plate VIII, Figure 42

Description (Based on 5 of several specimens): Body 1.152-1.74 long, 1.368-1.57 wide, rhomboidal in shape. Cuticle thick; spines not observed. Acetabulum 0.165-0.277 in diameter, spherical, slightly preequatorial, median, at 0.462-0.612 from anterior end. Oral sucker 0.137-0.2 by 0.152-0.233, subspherical, sub-

terminal. Sucker ratio 1:1.15-1.26. Prepharynx indistinct; pharynx 0.054-0.116 by 0.075-0.165, subspherical; esophagus 0.03-0.11 long followed by cecal bifurcation; ceca simple, straight, reaching posterior extremity. Testes 0.24-0.3 by 0.146-0.227, entire, oval, symmetrical, on either side of acetabulum, equatorial or slightly preequatorial. External seminal vesicle saccular, dorsodextral to acetabulum, extending beyond its posterior margin. Cirrus sac 0.336-0.504 by 0.11-0.134, club-shaped, lying obliquely between acetabulum and genital pore, enclosing internal seminal vesicle, well developed pars prostatica and cirrus in its neck region; cirrus tubular, protrusible. Genital pore marginal, sinistral to oral sucker. Ovary highly lobed, median, posttesticular, postacetabular. Seminal receptacle saccular, between ovary and acetabulum. Laurer's canal present. Vitellaria consisting of small follicles occasionally becoming tubular, from level of cecal bifurcation to slightly short of posterior extremity, filling wing like lateral sides of body. Uterus scanty, coils between ovary and cirrus sac; metraterm distinct. Eggs (from an unmounted specimen) 51-60 x 33-48 μ. Excretory vesicle tubular, extending up to ovary; excretory pore terminal.

Host: Drepane punctata (L.)

Site: Intestine

Locality: Veraval

This species resembles Transversocreadium cablei n. gen., n. sp. in general topography of internal organs but differs from it mainly in having rhomboid body and only two testes instead of ten.

Family Opecoelidae Ozaki, 1925

Plagioporus longicaudus n. sp.

Plate VIII, Figure 43

Description (Based on two specimens): Body 2.611-3.552 long, 0.612-0.8 wide, elongate, subcylindrical, slightly expanded at acetabular zone. Cuticle unarmed. Acetabulum 0.226-0.33 in diameter, spherical, at 0.753-1.059 from anterior extremity. Oral sucker 0.173-0.237 in diameter, subspherical, terminal, smaller than acetabulum; mouth subterminal. Sucker ratio 1:1.4-1.5. Prepharynx indistinct, probably lacking; pharynx 0.116-0.14 by 0.14-0.161, globular, muscular; esophagus about 0.205 long; cecal bifurcation nearer to oral sucker than to acetabulum; ceca not quite reaching posterior extremity. Testes 0.249-0.365 by 0.164-0.247, oval or globular, entire or slightly irregular, tandem, immediately postequatorial. Cirrus sac claviform, posterior extent well clear of anterior border of acetabulum enclosing a coiled seminal vesicle, pars prostatica with gland cells and a cirrus, opening at about midesophageal level left of median line. Ovary 0.087-0.131 in diameter, globular, immediately anterior to ovary, slightly right of median line. Seminal receptacle

dorsal to and much larger than the ovary, right of median line. Shell gland anterosinistral to ovary and seminal receptacle. Laurer's canal present. Vitelline follicles extending from cecal bifurcation to posterior end, continuous although follicles becoming fewer at right of acetabulum, confluent in posttesticular space. Uterus between ovary and genital pore; matraterm differentiated. Eggs 74-82 x 38 47 μ. Excretory vesicle tubular, extent not observed; excretory pore terminal.

Host: Cynoglossus lida (Bleeker)

Site: Intestine

Locality: Tuticorin

In the shape of body together with appreciably longer posttesticular space and in the extent and distribution of vitellaria, Plagioporus longicaudus n. sp., becomes quite distinguishable from all the known species of the genus Plagioporus. The new species can also be separated from the known species in one or more of the following characters: position of the genital pore, posterior extent of the cirrus sac, position, nature and arrangement of the gonads and the size of the eggs.

Paropecoelus indicus n. sp.

Plate IX, Figure 44

Description (Based on 5 of 18 specimens): Body 4.512-

5.82 long, 0.288-0.42 wide, elongate, narrow; forebody short and tapering anteriorly; hind body long and subcylindrical. Cuticle unarmed. Acetabulum pedunculate, 0.158-0.197 deep, 1.149-0.19· long, spherical, with four pairs of biramus peripheral papillae - two pairs antero-lateral and two pairs posterolateral, two pairs of simple and independent apertural papillae each on upper and lower lips. Oral sucker 0.091-0.098 deep, 0.084-0.119 long, globular, **ventro**terminal. Sucker length ratio 1:1.6. Accessory sucker absent. Prepharynx short; pharynx 0.081-0.084 by 0.072-0.093, globular, muscular, esophagus indistinct; ceca simple becoming obscure at posterior end due to vitellaria. Testes 0.33 -0.414 by 0.193-0.266, bilobed, occasionally entire, tandem, widely separated, in middle of posterior half of body. Posttesticular space 1.206-1.576. Cirrus sac short, indistinct, enclosing cirrus and short pars prostatica. Seminal vesicle tubular, very long, winding, extending posteriorly, halfway between ovary and acetabular peduncle. Genital pore ventrosinistral to esophagus. Ovary usually 4-lobed, occasionally 3-lobed, pretesticular, equatorial. Seminal receptacle absent. Uterine seminal receptacle present. Laurer's canal not observed. Vitellaria follicular from halfway

between ovary and acetabular peduncle to posterior extremity. Uterine coils preovarian. Eggs 30-42 x 21-33 μ. Excretory vesicle tubular, extending up to ovary; excretory pore terminal.

Host: Parupeneus indicus (Shaw)

Site: Intestine

Locality: Tuticorin

The condition of the intestinal ceca could not be ascertained due to vitellaria. Its inclusion in the genus Paropecoelus Pritchard, 1966 is based on the presence of both peripheral and apertural papillae along with the absence of accessory sucker. In having a similar pattern of acetabular papillae Paropecoelus indicus n. sp., comes very close to P. adelongatus (Nagaty, 1954) Pritchard, 1966. However, in the former, the vitellaria extend up to halfway between ovary and acetabular peduncle whereas in the latter it is up to ovary only. Further, the new species has equatorial ovary (as compared to preequatorial in P. adelongatus), smaller posttesticular space (¼th of body as against 1/3rd) and smaller eggs. It also differs from P. palawanensis (Fischthal and Kuntz, 1964) Pritchard, 1966 in not having basal processes in apertural papillae, equatorial ovary as compared to preequatorial one.

smaller posttesticular space and smaller eggs. From P. sognadaresi Pritchard, 1966 the new species differs mainly in the pattern and number of peripheral papillae, lobed and preequatorial position of ovary.

KEY TO SPECIES OF PAROPECOELUS Pritchard, 1966

1. Vittellaria nearly reaching acetabular peduncle 2

   Vitellaria reaching halfway between ovary and acetabular peduncle 3

   Vitellaria reaching level of ovary 5

2. Vitellaria continuous; ovary lobed ... P. quadratus

   Vitellaria discontinuous; ovary entire. P. elongatus

3. Apertural papillae with basal processes ..... P. palawanensis

   Apertural papillae without basal processes 4

4. 8 pairs of peripheral papillae; apertural papillae present ..... P. sogandaresi

   4 pairs of peripheral papillae; apertural papillae present .....P. indicus n. sp.

   4 pairs of peripheral papillae; apertural papillae absent ..... P. elongatus

5. Ovary entire ..... P. thapari

   Ovary lobed 6

6. Seminal vesicle saccular; 8 pairs of peripheral papillae ..... P. sacculatus

   Seminal vesicle tubular; 4 pairs of peripheral papillae ..... P. adelongatus

Dactylostomum sulphurei n. sp.

Plate IX, Figure 45

Description (Based on 5 of several specimens): Body 1.706-2.611 long, 0.259-0.4 wide at testicular level, elongate, narrow, with a stalk near anterior end; forebody short and tapering anteriorly; hind body long, subcylindrical. Cuticle aspinose. Acetabulum 0.137-0.208 long, 0.134-0.191 deep, shperical, pedunculate, with two pairs of anterolateral and two pairs of posterolateral biramus peripheral papillae, one pair of anterior and one pair of posterior simple and isolated apertural papillae with basal protuberances. Oral sucker 0.063-0.108 long, 0.063-0.087 deep, subglobular, ventroterminal. Suckers' length ratio 1:1.57-2.1. No accessory sucker. Prepharynx 0.003-0.029 long; pharynx 0.055-0.084 long, 0.059-0.099 wide; cecal bifurcation indistinct, somewhere between level of acetabular stalk and pharynx; ceca unite near posterior extremity forming a cyclocoel gut. Testes 0.158-0.223 by 0.116-0.175, irregular in outline, tandem, separated by vitellaria, in middle of posterior half of body. Cirrus sac short, indistinct, enclosing cirrus and short pars prostatica. Seminal vesicle tubular, winding, extending halfway between ovary and acetabular stalk. Genital pore anterior to

acetabular peduncle, sinistral to median line. Post-testicular space 0.365-0.647. Ovary usually 4-lobed, sometimes 3-lobed, pretesticular, median. Seminal receptacle absent. Sperm cells present in proximal coils of uterus. Laurer's canal probably present. Vitellaria follicular, in 4-rows from testicular level to posterior end, intruding into preovarian region up to level of seminal vesicle; vitelline reservoir anterior to ovary. Uterus scanty, between ovary and genital pore; metraterm indistinct. Eggs 45-49 x 25-30 μ, few. Excretory vesicle tubular, extending forward up to ovary; excretory pore terminal.

Type Host: Upeneus sulphureus Cuvier

Other Host: U. tragula Richardson

Site: Intestine

Type Locality: Madras

Other Locality: Tuticorin

In the extent of vitellaria this species comes very close to Dactylostomum caballeroi Martin, 1960. However, it differs from Martin's species in having a stalked acetabulum, in the nature, number and distribution of acetabular papillae and in the absence of prostatic cells at the base of cirrus sac.

It appears that an accessory sucker is also present

in the above species near about ventral to cecal bifurcation as Pritchard (1966) has indicated in the case of Dactylostomum caballeroi. If this is the case then, these two species (i.e., D. caballeroi and D. sulphurei n. sp.) should form a new genus distinct from Dactylostomum Woolcock, 1935 as suggested by Pritchard (1966).

Pseudopecoelina elongata n. sp.

Plate IX, Figure 46

Description (Based on 3 specimens): Body 2.531-3.396 long, 0.204-0.24 wide, elongate narrow, with a short peduncle or protuberance bearing acetabulum near anterior extremity; forebody short and tapering anteriorly; hind body long, subcylindrical, posterior extremity rounded or pointed. Cuticle unarmed. No accessory sucker in forebody. Acetabulum 0.152-0.179 long, 0.164-0.178 deep, spherical, without papillae. Oral sucker 0.11-0.12 long, 0.083-0.113 deep, subglobular, ventroterminal. Suckers' length ratio 1:1.38-1.62. Prepharynx 0.009.0.013; pharynx 0.074-0.09 by 0.09-0.096, globular, muscular; esophagus short; ceca simple, becoming obscured posteriorly due to vitellaria, probably joining near posterior end to form cloaca. Testes 0.155-0.256 long, 0.134-0.164 wide, oval or spherical,

tandem, separated by vitellaria, in middle of posterior half of body. Cirrus sac long, tubular, extending far back of acetabulum containing long, tubular seminal vesicle, a short pars prostatica and ejaculatory duct, dialating peculiarly before termination. Genital pore ventral, postpharyngeal. Posttesticular space 0.765-0.93. Ovary 0.104-0.113 in diameter, spherical, median, pretesticular, separated from anterior testes by vitellaria. Seminal receptacle absent. Shell gland preovarian. Laurer's canal not observed. Vitelline follicles from postacetabular level to short of posterior extremity, less dense in testicular and ovarian zones. Uterus scanty, preovarian. Eggs collapsed 69-76 x 30-39 μ. Excretory vesicle tubular, its extent obscure due to vitellaria; excretory pore terminal.

Type Host: Upeneus bensasi (Schlegel)

Ohter Host: Upeneus taeniopterus Cuvier

Type Locality: Mandapam

Other Locality: Madras

The present species has been placed under the genus Pseudopecoelina Yamaguti, 1942 because of the absence of an accessory sucker and acetabular papillae and presence of a long and tubular cirrus sac. The condition of the posterior part of ceca could not be ascer-

tained. Psuedopecoelina elongata n. sp., has a characteristic ventral dilatation of cirrus sac near genital pore before termination. It differs from the type species. P. dampieriae Yamaguti, 1942 in the shape and size of the body, larger posttesticular space, larger egg size and in having a dilatation of cirrus sac near genital pore.

Pseudopecoeloides chorinemi n. sp.

Plate IX, Figure 47

Description (Based on 2 specimens) Body 6.828-7.056 long, 0.504-0.582 wide, elongate, with a short peduncle near anterior extremity; forebody short, tapering anteriorly; hind body long, subcylindrical. Cuticle smooth. Acetabulum 0.218-0.236 long, 0.215-0.225 deep, on a short peduncle, without papillae. Oral sucker 0.212-0.221 long, 0.206-0.221 deep, subglobular, ventroterminal. Suckers' length ratio 1:1. No accessory sucker. Prepharynx short; pharynx 0.12-0,135 by 0.123-0.143, globular, muscular; esophagus indistinct; cecal bifurcation probably slightly anterior to acetabular peduncle; ceca simple, joining excretory vesicle laterally near posterior end to form a uroproct. Testes 0.265-0.324 by 0.209-0.24, oval, entire, tandem, widely

separated from each other, in middle third of hind body. Cirrus sac rudimentary, enclosing cirrus and short pars prostatica. Seminal vesicle tubular, long, winding; pars prostatica indistinct; cirrus long, protrusible; genital pore sinistral to median line, ventral at posterior level of pharynx. Posttesticular space 2.324-2.511. Ovary 0.18 by 0.166, spherical, entire, median, in front of anterior testis. Seminal receptacle absent. Laurer's canal not observed. Vitellaria follicular, not reaching level of acetabular peduncle, lateral in pretesticular region; vitelline reservoir immediately anterior to ovary. Uterine coils preovarian. Eggs 54-72 x 30-42 μ. Excretory vesicle tubular, extending up to ovary.

Host: Chorinemus tol Cuv. and Val.

Site: Intestine

Locality: Tuticorin

Pseudopecoeloides chorinemi n. sp., is most like P. carangis (Yamaguti, 1938) Yamaguti, 1940 but differs from it in having a more cylindrical body, larger body size; the testes and ovary being widely separated (close together in P. carangis), posterior position of genital pore and in the shape of the oral sucker.

Podocotyloides parupenei (Manter, 1963) Pritchard, 1966

Plate IX, Figure 48

Host: Therapon puta* Cuv. and Val., from Madras** and Tuticorin;** Therapon theraps* Cuv. and Val., from Madras; and Nemipterus japonicus* (Bloch) from Tuticorin.

Site: Intestine.

Although the stalk is withdrawn in most of 30 specimens collected, the acetabulum appears slightly protruded. Other details agree and measurements overlap firly well with the description of Podocotyloides parupenei as provided by Manter (1963). However, the papilla-like knob at one end of eggs is not distinctly seen and in some specimens the genital pore is slightly posterior to the base of the pharynx.

HAMACREADIUM Linton, 1910

Nagaty (1956) proposed the genus Cainocreadoides distinct from Cainocreadium Nicoll, 1914 on the basis of oblique testes, multilobed ovary, muscular metraterm and elongate pharynx, and from Hamacreadium Linton, 1910, on the basis of median genital pore in the former. The type species Cainocreadoides serrani Nagaty, 1956 has a long excretory vesicle reaching acetabulum. The species

of Cainocreadium invariably have tandem testes, lobed or entire ovary, median genital pore and a short excretory vesicle. Nagaty transferred Hamacreadium epinepheli Yamaguti, 1934 to Cainocreadoides. Although, Manter (1963) doubts its distinctness from Cainocreadium, he is of the opinion that Hamacreadium lintoni Siddiqi and Cable, 1960, which also has almost median genital pore, may be grouped under Cainocreadoides. It becomes obvious that Manter does not seem to agree with Sogandares and Sogandares (1961) who demonstrated that both H. lintoni and H. longisaccum fall within the range of variations observed for H. mutabile and considered these two species as synonyms of the latter. However, H. lintoni has a "simple" metraterm and a globular or subglobular pharynx. These two characters are not suggestive of its inclusion in Cainocreadoides which has been characterised by "muscular" metraterm and elongate pharynx. However, body shape and distribution of vitellaria may be misleading to consider H. lintoni distinct from H. mutabile. Sogandares and Sogandares (1961) have shown that H. mutabile has a wide range of body shapes and that it has been recorded from Epinephelus striatus in Bimini, Bahamas, one of the hosts of H. lintoni. Further, the variation in the

distribution of vitellaria in H. mutabile has also been observed from the material in the present collection. Thus, Sogandares and Sogandares are justified in synonymising H. lintoni with H. mutabile. They have also shown that the posterior extent of the cirrus sac is highly variable and in one specimen it extends posteriorly well beyond acetabulum. Therefore, H. longisaccum, based mainly on this character, is a synonym of H. mutabile.

Manter (1963) believes and concurs with Nagaty that median position of the genital pore is the telling character to separate Cainocreadoides from Hamacreadium. It is to be pointed out that median genital pore alone is not sufficient to distinguish Cainocreadoides from Hamacreadium because H. guilela Linton, 1910, H. consuetum Linton, 1910 and H. mehsena Nagaty, 1941 also have median genital pores. Thus the whole idea of Cainocreadoides falls within the broader concept of Hamacreadium. Therefore, Cainocreadoides, although definitely distinct from Cainocreadium, does not stand valid against Hamacreadium and becomes synonymous with the latter. Consequently, Cainocreadoides serrani Nagaty, 1956 would become Hamacreadium serrani but this

name is already preoccupied by a homonym, H. serrani Nagaty and Abdel Aal, 1962. Therefore a new name Hamacreadium abdelaali nom. nov., is here proposed for Cainocreadoides serrani.

Manter feels justified to retain Emmetrema Caballero, 1946 distinct from Hamacreadium Linton 1910 in two characters: postovarian extent of the uterus together with median genital pore. Obviously, he seems to have been unaware at that time of Lamothe's (1962) redescription of Hamacreadium lariosi (Caballero, 1946) Yamaguti, 1953 where the genital pore is single instead of two separate male and female genital pores, and is dextrally submedian in midesophageal level instead of being median at cecal bifurcation as originally described. Thus the genital pore is not constant in position and, therefore, not reliable for generic considerations. Only the character of postovarian extent of uterus cannot be used for the retention of Emmetrema because Hamacreadium krusadaiensis Gupta, 1956 and Hamacreadium equulai n. sp., (to be described below) also show this character.

Hamacreadium mutabile Kinton, 1910

Plate X, Figures 49, 50

Hots: Lutianus rivulatus* (Cuvier), from Veraval;**
Lutianus quinquelinearis* (Bloch), from Karwar*
Lutianus fulviflamma (Forskål), from Tuticorin°
Lethrinus frenatus* Val., from Tuticorin**

Site: Intestine

The specimens from Lutianus rivulatus have somewhat elongated vitelline follicles rather than globular and extend up to the level of pharynx. Those from Lutianus quinquelinearis have vitellaria reaching short of cecal bifurcation, possess quite wide cecal arch and have excretory vesicle reaching cecal bifurcation or slightly anterior to it. In all these specimens the genital pore is ventral to left cecum. Those from Lutianus fulviflamma and Lethrinus frenatus, both collected from the same catch, have vitellaria up to the cecal bifurcation, ovary trilobed to multilobed; genital pore lying a little outward to left cecum; and testes have tendency towards lobation or indentation. Gupta's (1956) Hamacreadium leiperi having trilobed ovary and genital pore a little inward to left cecum, falls well within these variations. Hence H. leiperi becomes a synonym of H. mutabile. Gupta collected his material from a

"marine cat-fish" which is rather unusual since almost all the species of Hamacreadium have been reported from lutianids, lethrinids or serranids.

Hamacreadium krusadaiensis Gupta, 1956

Plate X, Figure 51

Host: Lethrinus frenatus* Val.

Site: Intestine

Locality: Tuticorin**

Two specimens of this species 0.776-1.329 long, 0.342-0.588 wide were recovered along with the specimens of H. mutabile from the above host fish. The smaller specimen is not good and, therefore, can be studied only partially. The sucker ratio is 1:1.88-2.12; ovary is trilobed; anteriorly the vitellaria stop behind cecal bifurcation; testes are wedge-shaped and measure 0.137-0.263; and the eggs are 66-70 x 44-53 μ. Gupta found this species also from an "unidentified marine cat-fish".

Hamacreadium equulai n. sp.

Plate X, Figure 52

Description (Based on three specimens): Body 1.506-1.741 long, 0.353-0.435 wide at testicular level, elongate, tapering anteriorly, rounded posteriorly. Cuticle unarmed. Eye-spot pigment absent. Acetabulum 0.152-0.205 by 0.161-0.208, spherical, precquatorial. Oral sucker 0.087-0.111 deep, 0.161-0.19 wide, terminal; mouth terminal. Suckers' width ratio 1:1-1.2. Prepharynx indistinct; pharynx 0.058-0.073 by 0.065-0.078, globular, muscular; esophagus 0.17-0.225 long; cecal bifurcation almost halfway between pharynx and acetabulum; ceca reaching short of posterior extremity. Testes 0.184-0.263 by 0.131-0.187, slightly lobed, diagonal with left one anterior most, in posterior third of body. Cirrus sac very long, extending well posterior to acetabulum, containing coiled, tubular seminal vesicle; pars prostatica with prostatic gland cells, ejaculatory duct and cirrus. Genital pore post-bifurcal, sinistral, lying ventral to left cecum or outward to it. Ovary 2-4 lobed, right of median line, postequatorial, pretesticular. Seminal receptacle anterodorsal to ovary. Laurer's canal not seen. Vitellaria follicular, from level of cecal bifurcation

or slightly anterior to it to posterior extremity; vitelline reservior anterior to ovary. Uterus scanty, proximal coils filled with sperms, having postovarian extensions, metraterm indistinct. Eggs 75-90 x 56-66 u, thick-shelled. Excretory vesicle tubular, extent not observed; excretory pore subterminal, dorsal, with sphincter.

Hots: Equula daura Cuvier

Site: Intestine

Locality: Karwar

Hamacreadium equulai n. sp., is the only species so far in this genus which has terminally located disc-like oral sucker with terminal mouth, and cirrus sac extending posteriorly well beyond the acetabulum, a character sometimes exhibited by H. mutabile Linton, 1910. In possessing postovarian extension of uterine coils it resembles H. lariosi (Caballero, 1946) Yamaguti. 1953 and H. krusadaiensis Gupta, 1956 but stands apart from the former in that the uterine coils do not come in between the two testes, in the posterior extent of cirrus sac, and smaller sucker ratio; from H. krusadaiensis it is distinct in having a disc-like terminal oral sucker, more elongate body, much smaller sucker ratio, postacetabular extent of cirrus sac,

multi-lobed ovary and prebifurcal genital pore.

Opegaster paramacrorchis n. sp.

Plate X, Figure 53

Description (Based on 5 of 7 specimens): Body 2.628-3.27 long, 0.882-1.059 wide at acetabular level, elongate; forebody conical with anterior extremity rounded; posterior end broadly rounded. Cuticle unarmed. Acetabulum 0.294-0.342 by 0.282-0.365, spherical, with five papillae usually on upper lip, in one specimen on lower lip; at 0.476-0.659 from anterior extremity. Oral sucker 0.146-0.184 long, 0.162-0.205 wide, spherical, subterminal, smaller than acetabulum. Sucker ratio 1:1.7-2.2. Prepharynx 0.009-0.026; pharynx 0.087-0.108 by 0.099-0.125 globular, muscular; esophagus muscular, 0.059-0.125 long; cecal bifurcation halfway between suckers; ceca joining posteriorly to open through an anus some distance from posterior extremity. Testes 0.276-0.476 by 0.43-0.647, deeply lobed, tandem, separated by a short space, immediately postequatorial. Seminal vesicle saccular or claviform, extending well posterior to acetabulum or restricted to posterior limits of acetabulum or entirely preacetabular. Cirrus sac short and rudimentary, enclosing small internal

seminal vesicle, and few prostate cells. Genital pore sinistral, anterior to cecal bifurcation. Ovary 0.122-0.17 by 0.312-0.365, transversely elongated, pretesticular, slightly submedian; seminal receptacle absent; uterine seminal receptacle and Laurer's canal present. Vitellaria follicular, extending from cecal bifurcation to posterior end of body. Uterus voluminous, preovarian; metraterm well differentiated, long. Eggs 50-59 x 26-41 μ, thick-shelled with a protuberance at one end. Excretory vesicle long, tubular, traceable up to cecal bifurcation; excretory pore, subterminal, dorsal, surrounded by glandular cells.

Variations:

The two testes are usually separated from each other but in one specimen they are contiguous and unlobed. The posterior extent of seminal vesicle is usually well beyond the posterior margin of acetabulum. In some specimens it does not cross that limit. In one specimen it is completely preacetabular. The 5 acetabular papillae are located on the upper lip of the acetabulum. In one specimen they are entirely lacking from the upper lip and instead they are present on the lower lip.

Host: Apogonichthys ellioti (Day)

Site: Intestine

Locality: Visakhapatnam

This species bears close resemblance to Opegaster macrorchis Yamaguti, 1938 and O. ditrematis Yamaguti, 1942, In O. macrorchis the anus is quite close to the excretory pore; the prostatic gland cells are outside the cirrus sac; the eggs are longer and the acetabular papillae are 6 in number, distributed 3 on each lip; whereas in O. paramacrorchis n. sp., the anus is anteriorly removed from posterior end, the prostatic gland cells are inside the cirrus sac, and altogether 5 acetabular papillae are located usually on the upper lip and in one case on the lower lip, but never on both lips. In O. ditrematis the vitellaria reach pharyngeal level, the genital pore is a bit more anterior and certainly the number and distribution of acetabular papillae is different from that of the present species.

Opegaster trachinocephali n. sp.

Plate X, Figure 54

Description (Based on 2 specimens): Body 4.081-4.446 long, 1.024-1.082 wide, elongate, conical anteriorly, rounded posteriorly. Cuticle unarmed.

Acetabulum 0.376-0.431 in diameter, spherical, slightly protuberant, at 0.942-0.953 from anterior extremity, acetabular papillae lacking. Oral sucker 0.205-0.225 by 0.211-0.284, spherical, subterminal, smaller than acetabulum. Sucker ratio 1:1.66-1.8. Prepharynx 0.044-0.075 long; pharynx 0.146-0.188 by 0.202-0.211, globular, muscular; esophagus 0.353-0.412 long, cecal bifurcation in front of acetabulum; ceca joining short of posterior extremity to form a short common anal canal opening through anus slightly short of posterior end. Testes 0.178-0.205 by 0.249-0.353, entire, in middle one third of hind body. Cirrus sac saccular or claviform, extending slightly posterior to acetabulum, containing internal seminal vesicle and prostatic complex. Genital pore posterior to pharynx, well left of median line. No external seminal vesicle. Ovary 0.146-0.181 by 0.318-0.324, transversely elongated, submedian. Seminal receptacle absent but proximal coil of uterus filled with sperms. Vitellaria from middle of acetabulum to posterior extremity. Laurer's canal present. Uterus voluminous, preovarian; metraterm long and well differentiated. Eggs 47-62 x 26-38 μ, thick-shelled with a knob-like protuberance at one end. Excretory vesicle tubular, reaching ovary; excretory

pore subterminal, dorsal, surrounded by glandular cells.

Type host: Trachinocephalus myops Bl. and Schn.

Other host: Saurida gracitis Cuoy and Gaimard

Site: Intestine

Locality: Tuticorin

This new species comes close to Opegaster minimus (Tubangui, 1928) in the extent of vitellaria and absence of acetabular papillae. However, it difiers from the latter in the position of the acetabulum, genital pore and the anus, and in the posterior extent of the seminal vesicle.

DECEMTESTIS Yamaguti, 1934

The genus Decemtestis was established by Yamaguti (1934) for his three species, D. sillagonis, D. callionymi and D. ditrematis which have ten testes and non-filamented eggs with or without polar prolongation. Yamaguti (1934) also transferred Helicometrina azumae Layman, 1930 to Decemtestis because it has non-filamented eggs and different position of genital pore. Manter (1933) had placed H. azumae under the genus Rhagorchis Manter, 1931 firstly, because of its non-filamented eggs, and secondly, because of its morphological similarity to Rhagorchis odhneri Manter, 1931

and its occurrence in a related host. Srivastava (1936) added three more species, D. brevicirrus, D. mehrai, and D. biacetabulata, all from fishes of Bay of Begal. The last named species has two concentric acetabula, one enclosed within the other, a character hitherto unknown in any other trematode. Accordingly, Srivastava (1936) gave an amended diagnosis of Decemtestis. Later, more species were added to it by Yamaguti (1938, 1951, 1959), Park (1939) and Manter (1954). All these species, except the three Indian ones, have been described from the fishes of North Pacific. However, some weak criteria have been used to erect these species as has been pointed out by Manter (1954) and are also exhibited by the two species of the genus present in the collection.

Decemtestis mehrai Srivastava, 1936

Plate XI, Figures 55,56,57

Host: Gerres filamentosus* Cuv. and Val., from Madras**
Lutianus johnii* (Bloch), from Karwar**
Pomadasys maculatus* (Bloch), from Madras
Cynoglossus bilineatus* (Bloch), from Karwar
Tetrodon lunaris* Bl. and Schn., from Madras

Site: Intestine

Decemtestis brevicirrus Srivastava, 1936

Plate XI, Figure 58

Host: Therapon jarbua* (Forsk°al)

Site: Intestine

Locality: Madras**

A good collection of specimens of D. mehrai has been made from various fishes of the Bay of Bengal and the Arabian Sea. A detailed study of various populations of these specimens discloses that this genus exhibits appreciable variations in certain morphological characters. For example, among the five specimens of D. mehrai obtained from Lutianus johnii at Karwar, one possesses vitellaria discontinuous on the right side of acetabulum; while in the remaining three there is no interruption at all. Moreover, in four of these specimens vitellaria extend up to the level of pharynx while in the one which has interrupted vitellaria on either side of acetabulum the vitelline follicles remain restricted to cecal bifurcation only. Two specimens of the same species were also recovered from Gerres filamentosus at Madras. The larger specimen has continuous vitellaria and extend up to the level of pharynx, while in the smaller one they are interrupted posterolateral to acetabulum and the anterior extent falls

short of pharyngeal level. In all these specimens the cirrus sac just touches anterior border of acetabulum but in the smaller specimen from Madras with interrupted vitellaria it overlaps acetabulum almost to the middle of it. All the specimens collected from Cynoglossus bilineatus and Tetrodon lunaris from Karwar and Madras respectively, have interrupted vitellaria at acetabular level. All these specimens are regarded D. mehrai with some variations; the testes are large, posttesticular space quite short and the anterior extent of vitellaria slightly more anterior in some specimens. Some specimens of D. biacetabulata have also been recovered from Sillago sihama at Visakhapatnam and Madras. The Madras specimen is single and has vitellaria interrupted in acetabular zone.

From the foregoing it becomes evident that distribution of vitellaria and their anterior extent are variable characters in Decemtestis and therefore, should not be relied upon at least to be used singly to distinguish species. In the single specimen of D. brevicirrus obtained from Therapon jarbua, the extent of cirrus sac remains restricted well anterior to acetabulum, and also has vitellaria somewhat interrupted at level of acetabulum. The size of the testes is large and they

are amassed together rather than arranged in two rows. The size of testes, i.e., large or small, arranged in longitudenal rows or some of them thrown out of alignment, or all of them amassed together, also do not by themselves alone constitute characters of specific rank. For similar reasons care should also be excercised not to erect species in this genus merely on the basis of one or two specimens. In view of the above facts, D. parapercis Yamaguti, 1959 becomes a synonym of D. callionymi Yamaguti 1934. No morphological differences exist between D. sillagonis Yamaguti, 1934 and D. azumae (Layman, 1930) Yamaguti, 1934 except a very slight and insignificant difference in egg size. Hence D. sillagonis is here regarded a synonym of D. azumae, the latter emerging as the type species of the genus Decemtestis.

KEY TO SPECIES OF DECEMTESTIS Yamaguti, 1934

1. Cirrus sac not extending posterior to acetabulum 7

   Cirrus sac extending up to or beyond posterior border of acetabulum 2

2. Cirrus sac extending to posterior border of acetabulum; eggs 108-117 μ long ..... D. spari

Cirrus sac extending only slightly beyond posterior border of acetabulum; eggs 60-70 μ long ..... D. goniistii

Cirrus sac extending almost up to ovary 3

3. Ovary slightly indented ..... D. bera

Ovary deeply lobed 4

4. Vitellaria not extending up to genital pore ..... D. azumae

Vitellaria extending up to genital pore or beyond 5

5. Terminal portion of metraterm without muscular bulb ..... D. callionymi

Terminal portion of metraterm with muscular bulb 6

6. Ovary at midlevel of body; testes indented ..... D. neopercis

Ovary behind midlevel of body; testes entire ..... D. pagrosomi

7. Cirrus sac not reaching anterior border of acetabulum 8

Cirrus sac reaching anterior border or overlapping some part of acetabulum 9

8. Eggs small 60-55 x 30-37 μ ..... D. brevicirrus

Eggs long 73-78 x 34-39 μ ..... D. kobayashii

9. Sucker ratio 1:2 ..... D. megacotyla

Sucker ratio 1:1.5 10

10. Cirrus sac extending to middle of acetabulum ..... D. ditrematis

Cirrus sac extending to anterior border of acetabulum 11

11. Vitellaria extend up to posterior level of pharynx ..... D. takanoha

Vitellaria up to cecal bifurcation ..... D. mehrai

Two species of Decemtestis, D. biacetabulata Srivastava, 1936 and D. pseudolabri Manter, 1954 are very peculiar and quite distinct from the others in having two concentric acetabula. Some specimens of D. biacetabulata have also been recovered from Sillgo sihama from Visakhapatnam and Madras. From the study of these specimens it appears that this character is of generic rank as it was also pointed out by Manter (1954) and, therefore, a new genus Allodecemtestis is proposed for the reception of the above species.

ALLODECEMTESTIS n. gen.

Diagnosis: Body elongate, subcylindrical, ends broadly rounded. Cuticle unarmed. Acetabula two, one concentrically enclosed within the other, in anterior half of body. Oral sucker subterminal, smaller than acetabula. Prepharynx present; pharynx well developed; esophagus short, ceca simple, wide, almost reaching posterior extremity. Testes ten, spherical or slightly transversely elongated, usually in two longitudinal rows in posterior half of body or amassed together

irregularly. Cirrus sac elongated, claviform, somewhat overlapping acetabula, enclosing an elogated, coiled seminal vesicle, tubular pars prostatica surrounded by gland cells, ejaculatory duct and cirrus. Genital atrium shallow, situated halfway between pharynx and esophagus. Ovary lobed, pretesticular, median or slightly submedian. Receptaculum seminis large, dorsal to ovary. Shell gland and Laurer's canal present. Vitellaria follicular, from cecal bifurcation to posterior extremity, confluent or not in acetabular zone. Uterus pretesticular, intercecal. Eggs without polar prolongation. Excretory vesicle tubular, collecting canals joining in front of testes. Intestinal parasites of marine fishes.

Type species: Allodecemtestis biacetabulata (Srivastava, 1936) n. gen., n. comb.

Other species: Allodecemtestis pseudolabri (Manter, 1954) n. gen., n. comb.

Allodecemtestis biacetabulata n. gen., n. comb.

Plate XI, Figures 59,60

Synonym:

Decemtestis biacetabulata Srivastava, 1936

Host: Sillago sihama* (Forskål)

Site: Intestine

Localities: Visakhapatnam** and Madras**

HELICOMETRA Odhner, 1902 and Related Genera

There are four closely related genera which have eggs with unipolar filaments, Helicometra Odhner, 1902 Helicometrina Linton, 1910, Stenopera Manter, 1933 and Neohelicometra Siddiqi and Cable, 1960. The egg filaments are usually many times longer except in the case of Helicometra kyliotrema Pritchard, 1966, in which they are rudimentary and hook-like. The genus Helicometrina is distinguished from Helicometra mainly by the number of testes, which is usually 9 in the former and 2 in the latter, but includes species with testes less than 9 as well. The genus Stenopera also has two testes, but has been differentiated from Helicometra to include species with comparatively shorter forebody and cirrus sac extending posteriorly beyond acetabulum. Neohelicometra is characterised by a funnel-shaped oral sucker and ceca with separate ani.

So far eight species have been described under the genus Helicometrina. Out of these, H. nimia Linton, 1910, H. orientalis Srivastava, 1936, H. elongata Noble & Park, 1937, H. mirzai Siddiqi and Cable, 1960 and H. trachinoti Siddiqi and Cable, 1960 have 9 testes; H. parva Manter, 1933 has 5 testes; H. septorchis Srivastava, 1936 has 7 testes and H. quadrorchis Manter and Pritchard, 1960 has 4 testes. On the other hand, Deelman (1960) found "numerous intergrades" between H. nimia and H. elongata in a collection of several hundred specimens of Helicometrina "from a single species of host from one location". Consequently, he synonymised H. orientalis and H. elongata with the type species, H. nimia.

A good number of specimens of Helicometrina with varying number of testes have been recovered from various related or unrelated species of marine fishes. Specimens with differing number of testes have been found to occur in the same individual host fish or in more than one fish of the same species collected from the same catch. The various data are given in Table I.

From Platycephalus scaber only two specimens of Helicometrina were recovered, one with three and the other with four testes. Except for this character

TABIE I

	HOSTS	LOCALITY	NUMBER OF TESTES 3	4	5	6	7	8	9
1.	Platycephalus scaber* (2)	Karwar**	1	1	-	-	-	-	-
2.	Platycephalus indicus* (2)	Madras**	1	-	1	-	-	-	-
3.	Therapon puta* (1)	Madras**	-	1	1	-	-	-	-
4.	Therapon jarbua* (1)	Madras**	-	-	1	-	-	-	-
5.	Johnius axilaris* (2)	Visakhapatnam**	-	-	-	-	-	-	3
6.	Johnius glaucus* (3)	Madras	-	1	-	-	-	-	-
7.	Sciaena aneus (2)	Visakhapatnam	-	-	-	-	-	-	1
8.	Sciaena sina* (1)	Visakhapatnam**	-	-	-	-	-	1	1
9.	Lutianus johnii* (3)	Karwar**	-	-	-	1	-	-	-
10.	Lutianus rivulatus* (1)	Veraval**	-	-	-	-	-	-	1
11.	Lutianus quinquelinearis* (4)	Tuticorin**	-	-	-	-	-	-	2
12.	Serranus maculatus* (2)	Madras**	1	1	1	2	-	-	-
13.	Psettodes erumei* (1)	Madras**	-	-	-	1	-	-	-
14.	Sillago sihama (1)	Madras	-	2	-	-	-	-	-
15.	Epinephalus undulosus* (1)	Tuticorin**	-	-	-	-	-	-	1
16.	Pomadasys furcatum* (2)	Visakhapatnam**	-	-	-	-	-	-	1

Figure in parentheses is the number of fishes examined.

there is absolutely no difference between the two and both of them become indistinguishably similar to H. septorchis and H. orientalis. From Platycephalus indicus, a related host species, one specimen of Helicometrina with 3 testes and another with 5 testes were collected. Here too, the two specimens are exactly the same except the number of testes and are similar to H. septorchis and H. orientalis. In the case of Therapon puta two specimens each with 4 and 5 testes were obtained. They too bear close resemblance to the two Indian species. So is the case with the specimens having 3,4,5 and 6 testes obtained from Serranus maculatus. It is to be noted that all these specimens with 3,4,5,6,8 or 9 testes appear to be H. septorchis or H. orientalis except that obtained from Sciaena aneus which is being described here as a new species.

It appears from the facts cited above that the number of testes in the Indian specimens of Helicometrina, is a very variable character, and this multitesticular condition is probably derived by the subdivision of the two testes, a condition which is typiel of Helicometra. Evidence is not available as to how does this subdivision of testes take place. However, this can be examined in the light of Manter's

(1933), Manter and Pritchard's (1960) and Linton's (1910) remarks. In a population of Helicometra executa Linton, 1910, the number of testes varies from 0-2. Linton also observed that in the specimens having testes, the cells of the latter were "loosely clustered" and appeared "disintegrating". Manter (1933) attributes this to the "weakness of the male gonads", and in view of "the irregular variation in the number of testes in H. executa from none to one or two, and the unknown factor influencing this number, Helicometrina parva is perhaps more similar to Helicometra executa than it is to Helicometrina nimia. Its occurrence in large numbers in a single host of 36 examined also indicates the possibility that it may be a variety of Helicometra executa. Manter and Pritchard (1960) have noted that Helicometrina quadrorchis is much like Helicometra dochmosorchis, and the deeply lobed condition of testes in some of the specimens of the latter might have given rise to four testes condition in the former. In all cases of Helicometrina specimens recovered from the same fish host, there are no morphological differences except in the number of testes. This happens only in worms from some hosts. Moreover, the size of the testes in all of them is remarkably very small. With these facts

in mind along with Manter's remarks, one can see how the subdivision of testicular cells could be taking place under host influence, the exact factor being unknown.

Hence, the number of testes could not be used to separate Helicometrina from Helicometra; it might also not form a character to distinguish species as well, because the specimens with 4 testes in the present collection are definitely not Manter and Pritchard's Helicometrina quadrorchis, or the specimens with 5 testes are not Helicometrina parva. In the Indian specimens of Helicometrina the number of testes does not appear to be stable and therefore they are difficult to be assigned to a particular species. But one thing is definite that they are all strikingly similar to H. septorchis and H. orientalis, the two in their turn differing from each other principally in the number of testes only. On the basis of page priority, H. septorchis should be the valid species. H. orientalis together with all other specimens in the present collection having 3-9 testes and cirrus sac reaching anterior border of acetabulum or slightly overlapping it and genital pore ventral to cecal bifurcation or slightly beyond that should be considered as synonyms

of H. septorchis. According to Noble and Park (1937) "the location of the genital pore anterior to the intestinal bifurcation in Helicometrina elongata lessens the dissimilarity between the genus and closely related genera (Helicometra Odhner, 1902; Stenopera Manter, 1933; Decemtestis Yamaguti, 1934; ....." . The variability in the number of testes in various specimens of Helicometrina strongly suggests that this genus and Helicometra may not be two distinct genera. Had there been specimens with two testes also in the population of specimens with more than two testes, it would have been easier to conclude that the two genera are one and the same.

Siddiqi and Cable (1960) do not consider Stenopera as a genus distinct from Helicometra on the basis of a shorter forebody and a long cirrus sac extending posterior to acetabulum in the former. According to them these two characters are specific rather than generic and therefore, they synonymised Stenopera with Helicometra. Fischthal and Kuntz (1965) concur with this synonymy. However, Pritchard (1966) does not agree with this and revalidates Stenopera, listing under it five species with short forebody and a cirrus sac extending posterior to acetabulum. According to her,

these five species can be conveniently grouped together and separated from the species of Helicometra. However, Helicometra torta Linton, 1910 has a short forebody unlike other species of Helicometra. Further, in Helicometra pretiosa Bravo-Hollis and Manter, 1957, the forebody is short and the cirrus sac, although not very long, extends slightly posterior to acetabulum. These examples occupy an intermediate position between clear-cut species of Helicometra and Stenopera, and serve to support the view that short forebody and cirrus sac extending posterior to acetabulum hardly constitute a basis to consider Stenopera distinct from Helicometra.

Helicometrina pandei+ n. sp.

Plate XII, Figure 66

Description (Based on one specimen): Body 3.54 long, 0.859 wide, elongate, slightly tapering anteriorly, posterior end broadly rounded. Cuticle thin, smooth, aspinose. Eye-spot pigment absent. Oral sucker 0.202 by 0.21, spherical, subterminal; mouth circular. Acetabulum 0.33 by 0.294, spherical, preequatorial, larger than oral sucker. Sucker ratio 1:1.5. Prepharynx 0.044; esophagus 0.318; pharynx 0.093 by 0.108, longer than broad; cecal bifurcation in middle of pharynx and

+ Named after Prof. B.P. Pande.

acetabulum; ceca simple, reaching short of posterior extremity. Testes 9, each 0.175-0.228 by 0.167-0.211, arranged in two longitudenal rows on either side of median line, right row having 6 and left row 3, in posterior half of body. Cirrus sac clavate, curving round right border of acetabulum and extending well beyond acetabulum posteriorly containing a twisted seminal vesicle, a pars prostatica with prostatic gland cells and a cirrus; genital pore ventral to middle of esophagus. Ovary multilobed, submedian. Seminal receptacle 0.33 by 0.205, saccular, slightly dextral, preovarian. Laurer's canal present. Vitellaria follicular, extending from a little anterior to cecal bifurcation to posterior end of body, not confluent medially in posttesticular space. Uterus in helical coils between ovary and acetabulum; metraterm long. Eggs 56-80 x 23-35 μ, pyriform, with very long unipolar filaments. Excretory vesicle tubular, traceble up to ovary; excretory pore terminal.

Host: Sciaena aneus (Bloch)

Site: Intestine

Locality: Visakhapatnam.

There are four species of Helicometrina which have 9 testes: H. nimia Linton, 1910, H. elongata

Noble and Park, 1937, H. mirzai Siddiqi & Cable, 1960. and H. trachinoti Siddiqi & Cable, 1960. Helicometrina pandei n. sp., is distinguishable from all these in the postacetabular extension of the cirrus sac. It further differs from H. nimia in the position of the genital pore and larger egg size; from H. elongata in the distribution of vitellaria in the acetabular region and lobation of ovary; from H. mirzai mainly in the position of acetabulum, distribution of vitelline follicles in the acetabular region and position of genital pore; and from H. trachinoti in sucker ratio (1:2.4 in H. trachinoti) and longer posttesticular space.

Family Microphallidae Travassos, 1920

Spelotrema sp.

Plate XIII, Figure 67

Host: *Therapon jarbua* (Forskål)

Site: Intestine

Locality: Madras

Only two immature specimens were obtained. As this trematode is found in shore birds, its occurence in a marine fish appears to be a case of accidental parasitism.

Family Didymozoidae Poche, 1907

Didymocystis pseudobranchialis Job, 1964

Host: *Sphyraena picuda* Bloch

Site: Pseudobranch

Locality: Mandapam

Family Isoparorchiidae Poche, 1926

Elongoparorchis pneumatis Rao, 1961

Plate XIII, Figure 68

Host: Arius jella (Val.)

Site: Air bladder

Locality: Visakhapatnam

There are only two genera in this family. It is interesting to note that the other genus, Isoparorchis hypselobagri (Billet, 1898) Odhner, 1927 is commonly found in the swim bladder of a freshwater catfish, Wallago attu.

Family Monodhelminthidae Dollfus, 1937

Mehratrema dollfusi Srivastava, 1939

Plate XIII, Figure 69

Host: Arius platystomus* Day

Site: Intestine

Locality: Karwar**

The eggs in Mehratrema polynemusinis Chauhan, 1943 have been described to measure 5-8 x 2.6-4.1μ on page 135 which is totally erroneous according to the scale given by Chauhan (1943) in his Figs. 1 and 2. They

probably measure 50-80 x 26-41μ, which appear to be a more approximate size.

Bucklytrema indica Gupta, 1956

Host: Tachysurus nenga (Ham.)

Site: Intestine

Locality: Bombay**

Only one specimen in a poor condition was collected. However, it agrees fairly well with Gupta's (1956) description of the species except the following variations: the testes are larger and are directly diagonal instead of being separated as illustrated by Gupta, and the ovary is also larger and is more anterior in position and thus overlapped by the posterior part of cirrus sac and mass of gland cells at the base of the accessory organ.

Family Monorchiidae Odhner, 1911

In a bid to solve the long discussed controversy over the status of Lasiotocus Looss, 1907 and Proctotrema Odhner, 1911, Manter and Pritchard (1961) have suggested to separate the former from the latter on the basis of unlobed ovary. This criterion in this parti-

cular case seems to be too artificial. In L. beauforti (Hopkins, 1941) Thomas, 1959, the ovary is "nearly spherical with a slight tendency towards triangular shape", which implies that out of 12 specimens in Hopkins collection, some or at least one, had a triangular ovary indicating a possibility of trilobation. In L. pomadasi n. sp., a closely allied species, the ovary is deeply trilobed or triangular with slight tendency towards trilobation. These evidences indicate that the nature of ovary may be variable and alone can hardly be used for specific distinctness what to talk of utilising it to distinguish Lasiotocus from Proctotrema. Thus the broadbased treatment of Lasiotocus, Proctotrema and other closely related genera by Thomas (1959) solves most of the controversies regarding their confusing status and appears to be most natural.

Lasiotocus pomadasi n. sp.

Plate XIII, Figure 70

Description (Based on 5 of several specimens): Body 1.624-2.34 long, 0.312-0.444 wide, elongated, tapering gradually posteriorly, flatly rounded anteriorly. Cuticle spinose. Acetabulum 0.113-0.158 by 0.098-0.149, subspherical, median or slightly median, at 0.648-0.78 from anterior extremity. Oral sucker 0.149-

0.167 by 0.179-0.209, inverted bell-shaped, terminal. Sucker ratio 1:0.7-0.81. Prepharynx 0.009-0.021 long; pharynx 0.05-0.064 in diameter, subglobular, muscular; esophagus 0.084-0.179 long; cecal bifurcation at 0.322-0.408 from anterior extremity; ceca simple, ending somewhere in middle of posttesticular region, being exactly undetermined due to uterus. Testis one, 0.212-0.324 by 0.149-0.228, oval, slightly submedian, in middle one third of body, postacetabular, postequatorial. Cirrus sac elongate, extending posteriorly up to ovary, enclosing an elongate internal seminal vesicle, pars prostatica with glandular cells and club-shaped spined cirrus. Atrial spines present. Genital pore preacetabular. Ovary deeply trilobed or triangular with tendency towards tilobation, in middle of body, submedian. Seminal receptacle absent. Laurer's canal present. Vitellaria in two lateral buches, each of 6-8 large follicles, in ovarian zone. Uterus voluminous, filling most of posttesticular region, proximal part forming uterine seminal receptacle, entering terminal organ laterally anterior to middle of it; posterior part of terminal organ saccular, highly muscular, spined; metraterm tubular, spined. Eggs 16-27 x 8-12 μ. Excretory vesicle sac-like; extent undetermined due to uterus;

excretory pore terminal.

Host: Pomadasys hasta (Bloch)

Site: Intestine

Locality: Bombay

The present species resembles L. beauforti (Hopkins, 1941) Thomas, 1959 in the shape of the body and the oral sucker, but differs from it in having a pharynx smaller than acetabulum, prepharynx far smaller than esophagus, shorter ceca, cirrus pouch well overlapping ovary (not even reaching ovary in L. beauforti), cirrus with elongate spines rather than triangular ones and usually lobed ovary.

Family Gorgoderidae Looss, 1901

Anaporrhutum albidum Brandes in Ofenheim, 1900

Plate XIII, Figure 71

Host: Narcine timlei* Bl. and Schn.

Site: Body cavity

Locality: Madras**

Family Pleorchiidae Poche, 1926

Pleorchis sciaenae Yamaguti, 1938

Plate XIII, Figure 72

Hosts: Otolithus ruber* (Schneider) from Madras,** Tuticorin,** Calicut;** Pseudorhombus diacanthus* Bleeker from Calicut

Site: Intestine

Family Bivesiculidae Yamaguti, 1939

Bivesiculoides callyodoni n. sp.

Plate XIV, Figure 73

Description (Based on 4 of 6 specimens): Body 1.682-2.434 long, 0.67-0.824 wide at middle of body, tapering towards both ends, extremities rounded, a cap-like fold marked off from body at anterior extremity. Cuticle smooth, unarmed. No acetabulum. No oral sucker. Mouth a wide opening, terminal; prepharynx present; pharynx 0.09-0.113 by 0.111-0.146, globular, muscular; length of esophagus not determined due to invisibility of cecal bifurcation; extent of ceca obscure due to vitellaria. Testis one, 0.435-0.588 by 0.376-0.494, oval, in middle of posterior half of body. Cirrus sac

0.263-0.353 in diameter, in middle of body or slightly precquatorial, its contents and genital pore not determined. External seminal vesicle (?). Ovary 0.164-0.223 by 0.111-0.155, ovoid or elongate, antero-dextral, dextral or posterior to cirrus pouch, submedian. Seminal receptacle (?). Vitellaria follicular, between anterior cap-like body fold and posterior extremity, confluent in esophageal and posttesticular regions; vitelline reservoir posterior to cirrus pouch. Uterus pretesticular. Eggs 59-77 x 44-59 μ, thin-shelled. Excretory vesicle V-shaped; extent of arms not observed; excretory pore terminal.

Host: Callyodon dussumieri (Val.)

Site: Intestine

Locality: Tuticorin

Bivesiculoides Yamaguti, 1938 has three species, B. atherinae Yamaguti, 1938, B. otagoensis Manter, 1954 and B. posterotestis Durio and Manter, 1968. The present species is distinct from all three in having a cap-like body fold at anterior end, in the extent of vitellaria and large posttesticular space. It further differs from the three species in one or more of the following characters: position and shape of pharynx, shape of body, smaller eggs and topography of gonads.

Family Prosogonotrematidae Perez Vigueras, 1940

Prosogonotrema pritchardae n. sp.

Plate XIV, Figure 74

Description (Based on 4 of 6 specimens): Body 4.576-6.156 long, 1.417-1.687 wide, elongate, with rounded anterior and conical, blunt posterior end, highly muscular, very contractile when alive. Cuticle very thick and coarse. Acetabulum 0.756-1.093 by 0.81-1.12, spherical, bulging, far removed from anterior end, situated in posterior half of body. Oral sucker 0.31-0.432 by 0.405-0.526, spherical, subterminal; preoral lobe 0.07-0.112 wide. Sucker ratio 1:2.2. Prepharynx absent; pharynx 0.192-0.221 by 0.218-0.293, subglobular, slightly overlapped by oral sucker; esophagus a swelling. ceca arising from dorsal surface of esophageal swelling, wide, reaching posterior extremity. Testes 0.249-0.303 by 0.303-0.349, between suckers, subglobular, entire, symmetrical. Seminal vesicle tubular, coiled, in between or in front of testes or left testis only; pars prostatica very long, winding, well differentiated, surrounded by well developed prostatic gland cells; male duct coiled and covered with muscules at base of genital cone before entering latter, and opening at

Named after Mrs. M.L. Pritchard.

tip of cone. Genital cone 0.27-0.675 long, 0.094-0.202 wide at base, enclosed in an as long muscular genital atrium, opening ventral to or at base of oral sucker; sometimes cone projecting out through genital pore. Ovary 0.29-0.366 by 0.279-0.405, globular, entire, preacetabular, median (can be submedian due to pressing). Vitellaria seven, long, thin, winding tubules, mainly intercecal, sometimes dorsal to acetabulum, occasionally bifid at tips. Uterus voluminous, extending in tranverse coils between acetabulum and genital cone; metraterm winding at base of genital cone before entering it and running through it parallel to male duct to open separately at its tip. Uterine seminal receptacle present. Eggs 20-22 x 10-13 μ, very numerous. Excretory vesicle Y-shaped, stem reaching posterior level of acetabulum, arms uniting dorsal to pharynx.

Type host: Gastrophysus spadiceus (Richardson)

Other host: Anthias multidens (Day)

Site: Esophagus and intestine respectively

Locality: Karwar

Prosogonotrema Perez Vigueras, 1940 at present comprises of four species, P. bilabiatum Perez Vigueras, 1940, P. clupeae Yamaguti, 1952, P. carangi Velasquez, 1961 and P. subequilatum Pritchard, 1963. The present

species is distinct from the former three in smaller sucker ratio, body shape, extent of vitellaria and more posterior position of acetabulum. From P. subequilatum it differs in having more elongate body, larger sucker ratio; in the preacetabular position of ovary, number and extent of vitelline tubules and smaller eggs.

KEY TO SPECIES OF PROSOGONOTREMA Perez Vigueras, 1940

1. Acetabulum three times or more larger than oral sucker 2

   Acetabulum less than three times larger than oral sucker 3

2. Preoral lobe unlobed; eggs 27-30 μ long ..... P. clupeae

   Preoral lobe deeply lobed; eggs 33 x 20 μ ..... P. bilabiatum

   Preoral lobe slightly lobed; eggs 23-28 x 7-12 μ ..... P. carangi

3. Sucker ratio 1:2.2; vitelline tubules not reaching testicular level; ovary preacetabular ..... P. pritchardae n. sp.

   Sucker ratio 1:1.75; vitelline tubules reaching testicular level; ovary dorsoacetabular ..... P. subequilata

Family Acanthocolpidae Lühe, 1909

Acanthocolpus liodorus Lühe, 1906

Plate XIV, Figure 75

Host: Chirocentrus dorab (Forskål)

Site: Intestine

Localities: Bombay** and Veraval**

Acanthocolpus lühei Srivastava, 1939

Plate XIV, Figure 76

Host: Chirocentrus dorab (Forskål)

Site: Intestine

Localities: Bombay** and Veraval**

Yamaguti (1953) considered Acanthocolpus lühei Srivastava, 1939 a synonym of A. liodorus Lühe, 1906, and Caballero (1952) and Manter (1963) seem to agree. The author has found specimens of these species in the same population obtained from the same host, Chirocentrus dorab. A careful study of these specimens reveals that A. lühei does not agree with A. liodorus at least in the anterior extent of vitellaria, larger sucker ratio and in the absence of acetabular peduncle. It is therefore considered a valid species.

Acanthocolpus tenuis Manter, 1963

Plate XIV; Figure 77

Host: Chirocentrus dorab* (Forskål)

Site: Intestine

Locality: Tuticorin**

Only two specimens of this species were collected. One was decapitated and the other was fairly good for study. The specimen is larger in size (8.136) and the two suckers are farther apart.

Stephanostomum nemipteri n. sp.

Plate XV, Figure 78

Description (Based on 2 specimens): Body 3.96-.236 long, 0.383-0.42 wide, elongate, forebody tapering anteriorly, hindbody cylindrical with rounded posterior end. Cuticle spinose, having annulations between oral sucker and pharynx; body spines about 15 x 6 μ, becoming sparse posteriorly. Eye-spot pigment.present. Acetabulum 0.23-0.268 in diameter, spherical, at 0.96-0.972 from anterior extremity. Oral sucker 0.064-0.075 long, 0.104-0.125 wide, cup-like or funnel-shaped, terminal, with two rings of peribuccal spines- inner one having longer spines measuring about 29 x 6 μ, outer one having smaller spines measuring

about 15 x 6 μ, most of ventral spines lost, their exact number and completeness of ring undetermined, in paratype all spines lost. Sucker ratio 1: 2.62-2.73. Prepharynx 0.42 long; pharynx 0.164 long, 0.146-0.176 wide, pear-shaped, muscular; esophagus 0.084-0.156 long; bifurcation in front of acetabulum; ceca simple, reaching posterior extremity. Testes 0.268-0.3 by 0.161-0.188, elongate oval, tandem, separated by vitellaria (contiguous in paratype) in middle of posterior half of body. Posttesticular space 0.576-0.882. Cirrus sac long, reaching half way between acetabulum and ovary, enclosing seminal vesicle, a short pars prostatica surrounded by gland cells and a long spined cirrus. Genital atrium short. Genital pore immediately preacetabular, median. Ovary 0.134 by 0.149, subglobular, median, pretesticular, separated from anterior testis by a few vitelline follicles. Laurer's canal present. Vitellaria follicular, circumcecal, extending from postacetabular zone to posterior extremity, confluent between gonads and in posttesticular space. Uterus preovarian, proximal part containing some sperms; metraterm long, spined. Eggs collapsed, 60-78 x 48-57 μ. Excretory vesicle tubular. Uroproct probably absent.

Host: Nemipterus japonicus (Block)

Site: Intestine

Locality: Visakhapatnam

If the peribuccal rings of spines are uninterrupted ventrally then, according to Caballero's (1952) key, the present species comes close to Stephanostomum robustum (Mac Callum, 1917), Caballero, 1952, Stephamostomum californicum Manter and Van Cleave, 1951 and Stephanostomum coryphaenae Manter, 1947. The new species is distinguishable from all these in having a larger sucker ratio (1:2.62-2.73). It further differs from S. californicum in having long, spined cirrus and metraterm and smaller eggs (94-109 μ long in S. californicum); from S. robustum in longer posttesticular space, more anterior extent of vitellaria, and in that the vitelline follicles do not intrude between ovary and anterior testis; and from S. coryphaenae in having longer forebody and a different nature of cirrus sac (S-shaped and wider in anterior half in S. coryphaenae). If the peribuccal rings of spines are discontinuous ventrally then, the present species resembles S. bicoronatum (Stossich, 1883) Manter 1940 and S. cesticillum (Molin, 1858) Looss, 1899, but differs from the former in having a larger

sucker ratio, smaller genital atrium and in having the ovary separated from anterior testis by vitelline follicles; and from the latter in larger sucker ratio and shorter genital atrium only. This is also comparable to S. australis Manter, 1954. In view of a paratype of the present species which has contiguous testes, it is similar to S. australis Manter, 1954 but is easily distinguishable from it in sucker ratio (1:1.18-1.45 in S. australis), posttesticular space and in the posterior extent of the cirrus sac.

Stephanostomum attenuatum n. sp.

Plate XV, Figure 79

Description (Based on 2 specimens): Body 2.58-4.632 long, 0.3-0.432 wide, elongate, attenuated. Cuticle spinose; body spines 15-29 x 4 μ, becoming sparse posteriorly. Eye-spot pigment present. Acetabulum 0.209-0.283 in diameter, spherical, at 0.924-1.068 from anterior extremity. Oral sucker 0.09-0.101 by 0.125-0.155, cup-like or funnel-shaped, terminal, with 36 peribuccal spines in two complete rings, measuring 15-24 x 5 μ and 21-29 x 5 μ. Sucker ratio 1:1.94-2.22. Prepharynx 0.576-0.588; pharynx 0.155-0.206 by 0.09-0.134, pear-shaped, muscular; esophagus 0.051-0.09;

cecal bifurcation in front of acetabulum; ceca simple, reaching posterior end of body. Testes 0.137-0.312 by 0.14-0.242, oval, contiguous in posterior part of body. Posttesticular space 0.287-0.424. Cirrus sac long and slender, not reaching middle of body, enclosing a long seminal vesicle, short pars prostatica and short and armed cirrus. Genital atrium short; genital pore immediately preacetabular. Ovary 0.104-0.167 by 0.09-0.125, subglobular, contiguous with anterior testis, median. Vitellaria follicular, from behind cirrus sac to posterior extremity, sparse anterior to ovary. Uterus very scanty; metraterm long, and spined. Eggs 57-72 x 39-42 μ. Excretory vesicle tubular. Uroproct?

Host: Chorinemus tala Cuv. and Val.

Site: Intestine

Locality: Madras

In having peribuccal spines ventrally uninterrupted vitellaria reaching near the base of cirrus sac, contiguous testes and oral sucker smaller than acetabulum, this species comes close to S. imparspinae (Linton, 1905) Manter, 1940, S. anisotremi Manter, 1940 and S. sentum (Linton, 1910) Manter, 1947. However, from all these species, it is distinguishable in possessing an attenuated body, contiguous vitelline follicles

anterior to ovary and very scanty uterus. It further differs from S. imparspinae in the anterior extent of vitellaria, longer prepharynx, smaller pharynx, sucker ratio (1:1.26 in S. imparspinae), spined metraterm and cirrus, and ovary contiguous with anterior testis; from S. anisotremi in the anterior extent of vitellaria (reaching base of cirrus sac or beyond in S. anisotremi), number of peribuccal spines (38-40 in S. anisotremi) and in having the ovary contiguous with the anterior testis.

The author concurs with Sogandares-Bernal (1959) that S. sentum is distinct from S. minutum (Looss, 1901) Manter, 1940, which was synonymised with the latter by Caballero (1952).

Stephanostomum sp.

Host: Minous monodactylus (Bl. and Schn.)

Site: Liver and heart

Locality: Calicut

Nine larvae were found encysted in the liver and heart tissue. They were obtained alive by rupturing the cyst wall.

It appears that Minous monodactylus serves as a second intermediate host in this case. Since many

characters cannot be determined in the larval stage, these larvae have not been assigned to any species.

Stephanostomum adinterruptum n. sp.

Plate XV, Figure 80

Description (Based on one mature and one immature specimens); Body 2.538-2.568 long, 0.318-0.384 wide, elongate, cylindrical with rounded posterior end.

Cuticle spinose, spines 12-21 x 3-5 μ, becoming sparse posteriorly. Eye-spot pigment present. Acetabulum 0.145-0.168 in diameter, spherical, at 0.612-0.708 from anterior end. Oral sucker 0.14-0.143 by 0.173-0.175, spherical, terminal, with 36 spines in two complete circles, dorsal spines large and strong, 38-65 x 12-15 μ, lancet-like; ventral spines small and feeble, 29-38 x 10-12 μ. Sucker ratio 1:1. Prepharynx 0.252-0.336 long pharynx 0.143-0.161 long, 0.087-0.09 wide, pear-shaped, muscular; esophagus 0.03-0.042 long; cecal bifurcation in front of acetabulum; ceca simple, reaching posterior extremity. Testes 0.224-0.372 by 0.131-0.182, elongate oval, contiguous near posterior extremity. Posttesticular space 0.125-0.128. Cirrus sac long, reaching more than half way between acetabulum and ovary, enclosing a club-shaped seminal vesicle, short pars prostatica with

gland cells and a long tubular unarmed cirrus. Genital atrium short. Genital opening immediately preacetabular, median. Ovary 0.098-0.12 by 0.075-0.125 subspherical, contiguous with anterior testis, median. Vitellaria follicular, lateral and uninterrupted, not contiguous in posttesticular space, from posterior level of acetabulum to posterior extremity. Uterus preovarian, proximal coils with sperms; metraterm long, muscular, unarmed. Eggs collapsed 63-72 x 39-45 μ. Excretory vesicle tubular. Uroproct (?).

Host: Fistularia villosa Klunzinger

Site: Intestine

Locality: Visakhapatnam

Except for the larger number of peribuccal spines (36) which are ventrally uninterrupted and smaller sucker ratio (1:1), S. adinterruptum n. sp., is almost like S. interruptum Sparks and Thatcher, 1958. According to Caballero's (1952) key, the new species comes closer to S. casum (Linton, 1910) McFarlane, 1934 but differs from it in the shape of body, sucker ratio (1:1.4-1.7 in S. casum) and long and unarmed cirrus and metraterm. From S. fistulariae (Yamaguti, 1940) Manter and Van Cleave, 1951, the new species differs in the sucker ratio, position of ovary and in having a longer cirrus.

Tormopsolus mirzai[+] n. sp.

Plate XV, Figure 81

Desoription (Based on 2 specimens): Body 3.423-5.82 long, 0.348-0.54 wide, elongate, cylindrical, atten uating in the prepharyngeal region. Cuticle spinose, spines 15-21 x 4-5 μ, becoming sparse in posterior half of body. Eye-spot pigment present. Acetabulum 0.173-0.236 in diameter, spherical, at 1.068-1.548 from anterior end. Oral sucker 0.119-0.149 by 0.212-0.215, cup-like or funnel-shaped, terminal, without spines. Sucker ratio 1:1. Prepharynx 0.504-0.922 long; pharynx 0.173-0.209 by 0.125-0.161, pear-shaped, muscular; esophagus 0.072-0.194 long, cecal bifurcation between pharynx and acetabulum; ceca simple, reaching posterior extremity. Testes 0.076-0.564 by 0.066-0.252, elongate oval, tandem, contiguous, near posterior extremity; posttesticular space 0.131-0.365. Cirrus sac long, not quite reaching halfway between acetabulum and ovary, enclosing long, club-shaped seminal vesicle, short pars prostatica surrounded by gland cells, and a long tubular unarmed cirrus. Genital pore acetabular. Ovary 0.143-0.173 in diameter, spherical, median, pretesticular, separated from anterior testis by vitelline follicles. Vitellaria follicular, from behind acetabulum to

+ Named after Prof. M.B. Mirza.

posterior extremity, contiguous in posterior part of body. Uterus preovarian, proximal part filled with sperms functioning as uterine seminal receptacle, metraterm quite long, muscular, unarmed. Eggs collapsed 66-72 x 34-48 µ. Excretory vesicle tubular. Uroproct (?).

Host: Fistularia villosa Klunzinger

Site: Intestine

Locality: Visakhapatnam

Tormopsolus mirzai n. sp., comes close to T. lintoni Caballero, 1952 in the anterior extent of vitellaria but differs from it in having ovary postequatorial and separated from the anterior testis by vitellaria, long cirrus sac, cirrus and metraterm. It also deviates from T. osculatus (Looss, 1901) Poche, 1926 in having an oral sucker larger than pharynx, more posteriorly removed acetabulum, postequatorial position of ovary, more anterior extent of vitellaria (in T. osculatus vitelline follicles do not reach even posterior border of cirrus sac) and much longer cirrus sac, cirrus and metraterm. From T. orientalis Yamaguti, 1934 it differs mainly in having a longer forebody and in the anterior extent of vitellaria (in T. orientalis vitelline follicles do not reach even posterior level of cirrus sac). It is

distinct from T. filiformis Sogandares-Bernal and Hutton, 1959 in body shape (hair-like in T. filiformis), length of hermaphroditic duct (quite long in T. filiformis), presence of esophagus, anterior extent of vitellaria with respect to the position of acetabulur and posterior edge of cirrus sac and in having vitellaria uninterrupted at level of ovary and testes.

KEY TO SPECIES OF TORMOPSOLUS *Poche, 1906*

1. Vitellaria reaching almost posterior border of acetabulum 2

   Vitellaria remaining far behind acetabulum 3

2. Ovary contiguous to anterior testis; cirrus sac short ..... T. lintoni

   Ovary separated from anterior testis by vitellaria; cirrus sac long ... T. mirzai n. sp.

3. Body filiform; hermaphroditic duct very long extending far posterior to acetabulum; forebody quite long .....T. filiformis

   Body not filiform; hermaphroditic duct short extending only a short distance posterior to acetabulum; forebody short 4

4. Oral sucker shorter than pharynx; cirrus sac short ..... T. osculatus

   Oral sucker larger than pharynx; cirrus sac long ..... T. orientalis

Family Haplosplanchnidae Poche, 1925

Hymenocotta mulli Manter, 1961

Plate XV, Figure 82

Host: Chirocentrus dorab* (Forskål)

Site: Intestine

Locality: Visakhapatnam**

Only one specimen was collected. However, the Indian specimen is larger (6.528 x 1.02) in body size; has acetabulum well separated from pharynx, and seminal receptacle connected with two unusual dilatations full of sperms. It also varies in having seminal receptacle larger than ovary and a winding uterus.

Family Hemiuriidae, Lühe, 1901

Lecithocladium parviovum Yamaguti, 1953

Plate XVI, Figure 83

Host: Stromateus niger* (Bloch)

Site: Stomach

Locality: Veraval**

These specimens are larger in body size, have longer seminal vesicle and a very long and muscular metraterm.

Lecithocladium megalaspis Yamaguti, 1953

Plate XVI, Figure 84

Host: Megalaspis cordyla (L.)

Site: Stomach

Locality: Bombay**

The hermaphroditic duct studied in six specimens, extends to various distances between pharynx and anterior border of acetabulum. It appears that it is a variable character in Lecithocladium and care should be exercised in using it for specific considerations.

Lecithocladium glandulum Chauhan, 1945

Plate XVI, Figure 85

Host: Caranx carangus* (Bloch)

Site: Stomach

Locality: Bombay

Erilepturus lemeriensis (Tubangui and Masilungan, 1935) Manter, 1947

Plate XVI, Figure 86

Host: Chorinemus lysan (Forskål) from Visakhapatnam** & Karwar**

Caranx melampygus* Cuv. and Val., from Karwar

Therapon jarbua* (Forskål) from Karwar

Site: Stomach

The specimens recovered from the above fish hosts from the Bay of Bengal and the Arabian Sea agree fairly well with Velasquez' (1962) redescription of E. lemeriensis from Scomberoides lysan in general morphology except slight differences in certain body measurements and egg size (17-18 x 9-10 μ).

Erilepturus hamati (Yamaguti, 1934) Manter, 1947

Plate XVI, Figure 87

Host: Otolithus maculatus* Cuvier from Madras

Platycephalus indicus* (L.) from Madras** and Tuticorin**

Polynemus plebius* Broussonet from Tuticorin

P. tetradactylus* Shaw from Tuticorin

Site: Stomach

These specimens are larger in body size and have globular testes instead of wedge-shaped and juxtaposed

Parahemiurus dussumieri n. sp.

Plate XVII, Figure 88

Description (Based on 3 specimens): Body including ecsoma 2.085-2.138 long, 0.246-0.252 wide at level of vitellaria, elongate, thin; anterior extremity rounded; ecsoma 0.499-0.58 long, 0.18-0.195 wide, tapering posteriorly. Cuticle moderately thick with plications

on body proper; cuticle of ecsoma smooth. Acetabulum 0.101-0.112 by 0.108-0.115, spherical, at 0.293-0.317 from anterior extremity. Oral sucker 0.084-0.091 by 0.091-0.094, spherical, subterminal; preoral lobe 0.008-0.014 wide. Sucker ratio 1:1.2. Mouth ventroterminal; prepharynx indistinct; pharynx 0.073-0.084 by 0.063-0.07, oval, slightly overlapped by oral sucker; esophagus 0.148-0.189 long followed by cecal bifurcation; ceca simple, reaching short of posterior extremity. Testes 0.084-0.113 by 0.066-0.084, oval, entire, tandem almost equatorial, anterior testis and seminal vesicle separated by uterus. Seminal vesicle 0.112-0.147 by 0.056-0.07, saccular, with muscular walls (not very thick), pyriform with anterior tapering portion bent backwards, obliquely disposed in front of anterior testis, far removed from acetabulum; pars prostatica a long and winding duct, surrounded by well-differentiated prostatic gland cells up to posterior level of acetabulum only, entering sinus sac near anterior margin of acetabulum. Sinus sac a long tube, enclosing thin hermaphroditic duct, extending up to anterior margin of acetabulum. Genital pore at base of oral sucker. Ovary 0.066-0.087 by 0.08-0.108, reniform, subglobular, entire, median, posttesticular. Seminal receptacle

subglobular, dorsal to ovary and vitellaria. Vitellaria two compact masses, postovarian. Uterus descending into tail; metraterm entering sinus sac at its base to enter hermaphroditic duct. Eggs 21 x 12 μ, moderate in number. Excretory vesicle Y-shaped; arms uniting dorsal to oral sucker.

Host: Dussumieria acuta Cuv. and Val.

Site: Stomach

Localities: Tuticorin, Madras.

In sucker ratio and nature of vitellaria this species comes close to P. clupeae Yamaguti, 1953 but differs from it in having more attenuated body, longer pars prostatica, almost equatorial position of testes, in the shape of seminal vesicle, thickness of its wall, and ratio of body proper and tail. From all other species of Parahemiurus Vaz et Pereira, 1930 it is distinct at least in sucker ratio although other differences with individual species are also present.

Parahemiurus brevisinus n. sp.

Plate XVII, Figure 89

Description (Based on two specimens): Body including ecsoma 3.121-4.239 long, 0.408-0.607 wide at ovarian level, elongate, anterior extremity rounded. Ecsoma

1.333-1.782 long, 0.365-0.526 wide, truncate, posterior extremity abruptly pointed. Cuticle moderately thick with plications on body proper; cuticle of ecsoma smooth. Acetabulum 0.189-0.225 by 0.199-0.235, spherical, larger than oral sucker, at 0.335-0.499 from anterior extremity. Oral sucker 0.105-0.14 by 0.13-0.15, subspherical, subterminal; preoral lobe 0.007-0.014 wide. Sucker ratio 1:1.6. Prepharynx absent; pharynx 0.059-0.105 by 0.073-0.084, globular, slightly overlapped by oral sucker; esophagus a swelling; cecal bifurcation immediately posterior to esophageal swelling; ceca simple, swollen, reaching short of posterior extremity. Testes 0.168-0.225 by 0.171-0.196, subspherical, entire, preequatorial, obliquely placed just behind seminal vesicle, anterior testis separated from seminal vesicle by uterine coils. Seminal vesicle 0.196-0.35 by 0.14-0.192 with very thick (0.028-0.056) muscular walls, bulb-shaped, between testes and acetabulum; pars prostatica very long, surrounded by well differentiated prostatic gland cells up to midlevel of acetabulum only. Sinus sac fusiform, short, muscular, enclosing hermaphroditic duct, extending slightly posterior to pharynx, opening almost at base of oral sucker ventrally. Genital atrium indistinct. Ovary 0.133-0.15 by 0.147-0.207, spherical or

transversely elongated, entire, median, posttesticular, slightly above junction of soma and ecsoma. Seminal receptacle subglobular, dorsal to ovary and vitellaria. Uterine seminal receptacle present. Vitellaria 0.178-0.215 by 0.112-0.196, two compact masses with a tendency towards lobation, lying side by side posterior to ovary, may descend into ecsoma. Uterus descending almost up to 2/3rd of ecsoma; metraterm joining male duct at base of sinus sac to form hermaphroditic duct. Eggs 17-18 x 7-8 μ, moderate in number. Excretory vesicle dividing posterior to acetabulum and reuniting dorsal to pharynx at posterior level of oral sucker.

Host: Amblygaster sirm (Walbaum)

Site: Stomach

Locality: Tuticorin

In having a short and saccular sinus sac, it is distinct from all other species of the genus.

Parahemiurus indicus n. sp.

Plate XVII, Figure 90

Description (Based on 4 specimens): Body including ecsoma 2.74-4.671 long, 0.352-0.729 wide at ovariovitellarian zone, elongate, thin, slightly attenuating in anterior one half, then widening posteriorly; ecsoma

0.283-0.964 long, 0.243-0.594 wide, partly or completely invaginated. Cuticle thick with plications on body proper; cuticle of ecsoma smooth. Acetabulum 0.178-0.265 by 0.157-0.317, spherical, at 0.324-0.756 from anterior extremity. Oral sucker 0.136-0.261 by 0.147-0.317, spherical or bowl-shaped, terminal. Sucker ratio 1:1. Prepharynx indistinct; pharynx 0.07-0.175 in diameter, glubular, highly muscular; esophagus indistinct, ceca simple, wide, stout, reaching posterior end of body proper, occasionally descending into ecsoma. Testes 0.07-0.258 by 0.094-0.221, subglobular, overlapping each other, preovarian, almost equatorial. Seminal vesicle 0.07-0.332 by 0.059-0.196, bulb-shaped or elongated, with thick muscular wall, far behind acetabulum; pars prostatica a long, narrow, straight tube, surrounded by well differentiated prostatic gland cells only up to posterior margin of acetabulum. Hermaphroditic duct usually straight, enclosed in its pouch, extending up to anterior or posterior level of oral sucker. Ovary 0.126-0.168 by 0.147-0.252, entire, reniform, slightly submedian, postequatorial, posttesticular. Seminal receptacle anterodorsal to ovary. Uterine seminal receptacle present. Vitellaria two deeply lobed masses, each with 6-9 lobes; in holotype an isolated lobe of

vitellaria seen posterior to left mass. Uterus voluminous, extending posterior to vitellaria also; metraterm present. Eggs 18-22 x 9-14 μ, very numerous. Excretory vesicle Y-shaped; arms uniting dorsal to pharynx or oral sucker.

Type Host: Ilisha filigera (Val.)

Other Hosts: Thrissocles hamiltoni (Gray)

Thrissocles mystax (Bl. and Schn.)

Site: Stomach

Type Locality: Visakhapatnam

Other Localities: Tuticorin and Madras respectively

Parahemiurus indicus n. sp., has almost equal suckers, and in this character it is distinct from all other species of the genus.

Tubulovesicula angusticauda (Nicoll, 1915) Yamaguti, 1934

Plate XVII, Figures 91,92

Host: Platycephalus scaber* (L.)

Site: Stomach

Locality: Karwar**

The two specimens agree well with the redescription as provided by Manter and Pritchard (1960) except in sucker ratio (1:2.39 in the present specimens as against 1:1.7-1.8). Only in one of them the seminal vesicle

does not extend posterior to the acetabulum.

Allostomachicola secundus (Srivastava, 1939)Yamaguti,1958

Plate XVIII, Figure 93

Host: Chirocentrus dorab* (Forskål)

Site: Stomach

Locality: Bombay

Two specimens were collected in May, 1963. They vary from the original description and illustration in possessing a highly coiled hermaphroditic duct in the genital atrium. Srivastava has shown it to be a very short duct.

Stomachicola muraenesocis Yamaguti, 1934

Plate XVIII, Figure 94

Hosts: Muraenesox cinereus (Forskål), from Veraval;
Muraenesox talabonoides Bleeker, from Bombay

Site: Stomach

Aphanurus acanthophallus n. sp.

Plate XVIII, Figure 95

Description (Based on 5 of several specimens): Body 0.728-0.854 long, 0.172-0.189 wide at acetabular level, subcylindrical, posterior end rounded, anterior

conical, bulging at acetabular level. No ecsoma. Cuticle moderately thick with fine plications, conspicuous in anterior region, less so posterior to acetabulum. Acetabulum 0.112-0.122 in diameter, spherical, prominent, margin deeply incised forming four lobes although not so in the specimens from Clupea fimbriata, at 0.108-0.14 from anterior extremity. Oral sucker 0.052 in diameter, spherical, subterminal. Sucker ratio 1:2.25. Prepharynx absent; pharynx 0.035 in diameter, spherical, slightly overlapped by oral sucker; esophagus short; cecal bifurcation in front of anterior margin of acetabulum; ceca simple, reaching short of posterior extremity. Testes 0.045-0.066 by 0.045-0.073, globular, entire, diagonal, sometimes slightly overlapping each other, almost equatorial, preovarian. Seminal vesicle 0.133-0.196 by 0.038, elongated fusiform with fairly thick muscular wall, postacetabular, extending posteriorly dorsal to posterior margin of anterior testis; pars prostatica dorsal to acetabulum, surrounded by prostatic cells throughout its entire length. Hermaphroditic duct a straight tube, dorsoventrally oblique, extending posteriorly dorsal to acetabulum, opening into a short genital atrium ventral to oral sucker, anterior part a swollen knob-like structure studded with short

spines, often projecting out through genital pore ventral to oral sucker. Sinus sac a longitudenal muscular sheath enclosing hermaphroditic duct. Ovary 0.028-0.038 by 0.063-0.08, subglobular or transversely elongated, entire, median, immediately anterior to vitelline mass. Seminal receptacle not observed, in one specimen from Clupea fimbriata it is suspected to be present. Vitellaria 0.091-0.098 by 0.084-0.112, globular, indented anteriorly, immediately postovarian. Uterus reaching posterior end, beyond ceca; metraterm present, uniting with male duct at base of sinus sac dorsal to acetabulum. Eggs 14-18 x 8 μ. Excretory vesicle Y-shaped; excretory arms uniting dorsal to pharynx; excretory pore terminal.

Type Host: Clupea toli Cuv. and Val.

Other Host: Clupea fimbriata (Cuv. and Val.)

Site: Stomach

Locality: Bombay

It is distinct from all other members of the genus Aphanurus Looss, 1907 in the presence of a hermaphroditic duct with its anterior-most part clearly marked off and modified into a protrusible swollen structure beset with short fine spines.

Aponurus drepani n. sp.

Plate XVIII, Figure 96

Description (Based on 4 specimens): Body 1.134-1.606 long, 0.283-0.418 wide at acetabular level with almost rounded extremities, sometimes tappering posteriorly, without ecsoma. Cuticle moderately thick, smooth. Acetabulum 0.192-0.225 by 0.203-0.225, spherical, at 0.359-0.548 from anterior extremity. Oral sucker 0.087-0.115 by 0.091-0.115, spherical, subterminal. Sucker ratio 1:2.26. Prepharynx absent; pharynx 0.027-0.038 in diameter (distinct in type and in one paratype only), spherical, slightly overlapped by posterior portion of oral sucker; esophagus a swelling; ceca simple, reaching short of posterior extremity. Testes 0.077-0.091 in diameter (in type and in one paratype only; in others testes almost invisible due to coils of uterus), globular, entire, oblique with right one anterior-most, between ovary and acetabulum, ventral in position. Seminal vesicle 0.122 by 0.07 (in type only, in others it has been deformed), pyriform, anterodorsal to acetabulum placed obliquely; pars prostatica a long curved duct of uniform diameter throughout, surrounded by well-developed prostatic gland cells. Sinus sac 0.08 by 0.052 (distinctly seen in type only), oval, muscular,

extending posteriorly far beyond cecal bifurcation, opening directly ventrally at base of oral sucker; enclosing hermaphroditic duct. Ovary 0.066-0.105 by 0.07-0.157, globular, in one specimen transversely elongated, entire, ventral, median, immediately posterior to posterior testis. Seminal receptacle (distinctly seen in type only) 0.091 in diameter, dorsal to posterior testis, equal to ovary. Vitellaria comprising of seven rounded lobes, usually in groups of four and three, in one paratype six lobes arranged around a central one in stellate fashion, all lobes separate, posterior to ovary. Uterus voluminous, extending up to posterior end; metraterm present. Eggs 21-25 x 7-14 μ, pyriform, numerous, dark. Excretory vesicle Y-shaped, arms uniting dorsal to pharynx; excretory pore terminal.

Host: Drepane punctata (L.)

Site: Stomach

Locality: Tuticorin

Aponurus drepani n.sp., comes close to A. brevifor-mis Srivastava, 1939 in sucker ratio and egg size but differs from it in having more anterior genital pore, curved and longer pars prostatica than the seminal vesicle and in the position and size of the seminal receptacle. From all other species of the genus, the

new species differs in one or more of the following characters, such as sucker ratio, egg size, position of genital pore, disposition of testes, etc.

Brachadena sp.

Description (Based on one specimen): Body 0.768 long, 0.276 wide, plump, bulging at acetabular zone, both ends rounded, no tail. Cuticle thick with coarse surface. Acetabulum 0.191 by 0.197, prominent, 0.204 from anterior extremity. Oral sucker 0.066 by 0.0.68, spherical, subterminal. Sucker ratio 1:2.9. Prepharynx absent; pharynx 0.037 in diameter, rounded, slightly overlapped by oral sucker; esophagus not visible; ceca simple, reaching short of posterior extremity. Testes 0.033-0.05, in diameter, symmetrical, immediately posterior to acetabulum. Seminal vesicle 0.093 by 0.058, pyriform, thick-walled, anterodorsal to acetabulum; pars prostatica small, curved, surrounded by prostatic gland cells. Sinus sac 0.081 by 0.045, oval, enclosing hermaphroditic duct. Hermaphroditic duct opening into genital atrium. Genital pore ventral to oral sucker. Ovary not clearly seen due to thick elongated lobes of vitellaria. Seminal receptacle 0.093 in diamter, thick-

walled, spherical, in posterior one third of body, away from ovary and vitellaria. Vitellaria of seven elongated thick lobes, probably joined at one point. Uterus very scanty, extending up to posterior extremity. Eggs 30-39 x 18-21 μ, pyriform, thick-shelled, few, dark. Excretory arms uniting posterodorsal to oral sucker.

Host: Ilisha filigera (Val.)

Site: Stomach

Locality: Bombay

Since only one specimen is available, it could not be ascertained whether the vitelline lobes are centrally joined. It is, however, tentatively placed under Brachadena Linton, 1910 but has not been assigned to any species.

Hysterolecitha scatophagi n. sp.

Plate XVIII, Figure 97

Description (Based on 5 of 11 specimens): Body 1.764-4.2 long, 0.42-0.876 wide, elongate with both ends rounded. Ecsoma absent. Cuticle smooth. Acetabulum 0.274-0.516 by 0.271-0.492, spherical, at 0.48-0.948 from anterior extremity. Oral sucker 0.119-0.216 by 0.137-0.271, spherical or subspherical, subterminal; preoral lobe 0.013-0.045 wide. Sucker ratio 1:1.83-2.28.

Prepharynx indistinct; pharynx 0.03-0.104 by 0.06-0.125 globular, muscular, slightly overlapped by oral sucker; esophagus short; ceca forming stomach near bifurcation, and reaching posterior extremity. Testes 0.125-0.274 by 0.135-0.272, subglobular or transversely elongated, entire or slightly lobed, diagonal, postacetabular, separated by uterine coils. Seminal vesicle sac-like or tubular, preacetabular or slightly overlapped by anterior border of acetabulum; pars prostatica a swollen structure surrounded by well developed prostatic gland cells; hermaphroditic pouch globular, large, immediately postbifurcal; hermaphroditic duct wide, thick-walled, protrusible. Genital pore wide, immediately postbifurcal. Ovary 0.164-0.36 by 0.143-0.297, median, subglobular, near posterior end of body. No seminal receptacle. Vitellaria digitate, in two masses, right one with 3 lobes, left one with 4 lobes; lobes club-shaped, immediately postovarian. Uterine seminal receptacle present. Uterus voluminous, extending short of posterior extremity. Eggs 21-24 x 9-12 μ. Excretory vesicle bifurcating posterior to acetabulum and reuniting dorsal to pharynx.

Host: Scatophagus argus (L.)

Site: Stomach and intestine

Locality: Karwar

Of the 12 species of Hysterolecitha Linton, 1910 the present species comes close to Hysterolecitha tinkeri Manter and Pritchard, 1960, H. microrchis Yamaguti, 1934, H. xesuri Yamaguti, 1938 and H. nahaensis Yamaguti, 1942. However, it differs from H. tinkeri in body form, structure of terminal genitalia and unfilamented eggs; from H. xesuri in straight seminal vesicle, longer and swollen pars prostatica and shape of vitelline lobes; from H. microrchis in size of testes, swollen pars prostatica and number of vitelline lobes; from H. nahaensis in swollen pars prostatica, longer vitelline glands and more posterior position of vitellaria and ovary.

Family Accacoeliidae Looss, 1902

Tetrochetus coryphaenae Yamaguti, 1934

Plate XIX, Figure 98

Host: Balistis capistratus* Shaw

Site: Intestine

Locality: Tuticorin**

Only two specimens of this species were recovered. One is immature and the other is not completely mature.

They vary from Yamaguti's description in possessing thin, very long and winding vitellaria and in smaller eggs measuring 21-24 x 15 μ.

Family Hirudinellidae Dollfus, 1932

Uroproctinella attenuata n. sp.

Plate XIX, Figure 99

Description (Based on a single specimen): Body about 43 long, 5 wide at posterior part of body, elongate, attenuated behind acetabulum, posterior part club-shaped. Cuticle very thick (about 75 u), somewhat corrugated in posterior part of body, spines absent (might have disintegrated during processing); subcuticular muscular layer quite thick. Acetabulum 2.07 by 2.446, subspherical, prominent, near anterior extremity. Oral sucker 1.411 by 1.176, subspherical, subterminal. Sucker ratio 1:1.75. Prepharynx absent; pharynx 0.647-0.659 in diameter, pear-shaped, partly overlapped by oral sucker; esophagus short; just after cecal bifurcation each cecum having two dilatations, then extending posteriorly in a sinuous fashion, dilated in posterior swollen part of body, joining near posterior extremity and forming a uroproct with excretory vesicle. Testes

0.53 by 0.4-0.494, oval, slightly diagonal, postacetabular. Seminal vesicle about 0.131 wide, tubular, winding or coiled, surrounded by thick layer of small glandular cells; ejaculatory duct small, penetrating genital bulb dorsally, running through a genital papilla and opening at its tip. Genital bulb muscular, saccular, containing terminal parts of male and female ducts, both of them opening ventrally into genital atrium, lying posterior to cecal bifurcation. Genital atrium tubular, opening ventral to cecal bifurcation. Ovary 0.165 by 0.2, subglobular, median, well removed posteriorly from testes. Seminal receptacle absent. Shell gland quite large, immediately posterior to ovary. Laurer's canal present. Vitellaria branched, narrow, very long, highly convoluted tubules, extending from anterior level of anterior testis to almost end of attenuated part of body. Uterus extending posteriorly up to attenuated part of body, mostly in intercecal field, proximal part lying posterodorsal to shell gland filled with sperm cells to form uterine seminal receptacle; metraterm wide, long, swollen anteriorly, penetrating genital bulb on dorsal surface and opening on ventral wall of latter behind male opening. Eggs 15-24 x 12-17 μ, thick-shelled. Excretory stem short; collecting canals thin, thrown

into complicated coils, meeting dorsal to oral sucker; excretory pore terminal.

Host: Neothunnus macropterus (Schlegel)

Site: Stomach

Locality: Veraval

Uroproctinella attenuata n. sp., resembles the type and only species U. spinulosa (Yamaguti, 1938) Skrjabin and Guschankaja, 1957. However, the former can be distinguished from the latter by more attenuated body, winding seminal vesicle (twisted in U. spinulosa), position of ovary with respect to testes, smaller sucker ratio (1:2.16 in U. spinulosa) and smaller egg size.

HOST-PARASITE LIST

Amblygaster sirm (Walbaum)

Parahemiurus brevisinus n. sp.

Anthias multidens (Day)

Lepidapedon manteri n. sp.

Prosogonotrema pritchardae n. sp.

Apogonichthys ellioti (Day)

Opegaster paramacrorchis n. sp.

Arius jella (Val.)

Llongoparorchis pneumatis Rao, 1961

Arius platystomus Day

Mehratrema dollfusi Srivastava, 1939

Balistes capistratus Shaw

Pseudocreadium patellare Yamaguti, 1938

Tetrochetus coryphaenae Yamaguti, 1934

Callyodon dussumieri (Val.)

Bivesiculoides callyodoni n. sp.

Caranx carangus (Bloch)

Lecithocladium glandulum Chauhan, 1945

Caranx melampygus Cuv. and Val.

Erilepturus lemeriensis (Tubangui and Masilungan, 1935) Manter, 1947

Caranx sexfasciatus Quoy and Gaimard

Alcicornis thapari n. sp.

Chirocentrus dorab (Forskål)

Acanthocolpus liodcrus Luhe, 1906

Acanthocolpus lühei Srivastava, 1939

Acanthocolpus tenuis Manter, 1963

Allostomachicola secundus (Srivastava, 1937) Yamaguti, 1958

Hymenocotta mulli Manter, 1961

Chorinemus lysan (Forskål)

Erilepturus lemeriensis (Tubangui and Masilungan, 1935) Manter, 1947

Chorinemus tala Cuv. and Val.

Stephanostomum attenuatum n. sp.

Prosorhynchus chorinemi Yamaguti, 1952

Chorinemus tol Cuv. and Val.

Pseudopecoeloides chorinemi n. sp.

Clupea fimbriata (Cuv. and Val.)

Aphanurus acanthophallus n. sp.

Bacciger nicolli Palombi, 1934

Clupea toli Cuv. and Val.

Aphanurus acanthophallus n. sp.

Faustula basiri n. sp.

Faustula gangetica (Srivastava, 1935) Yamaguti, 1958

Cynoglossus bilineatus (Bloch)

Iepocreadioides indicum Srivastava, 1941

Cynoglossus dubius Day

Lepocreadioides indicum Srivastava, 1941

Cynoglossus lida (Bleeker)

Lepocreadioides indicum Srivastava, 1941

Plagioporus longicaudus n. sp.

Cynoglossus lingua Hamilton

Lepocreadioides indicum Srivastava, 1941

Cynoglossus macrolepidotus (Bleeker)

Lepocreadioides indicum Srivastava, 1941

Cynoglossus puncticeps (Richardson)

Lepocreadioides indicum Srivastava, 1941

Cynoglossus sindensis Day

Lepocreadioides indicum Srivastava, 1941

Decapterus russelli (Rüppell)

Monascus typicus (Odhner, 1911)

Drepane punctata (L.)

Aponurus drepani n. sp.

Calitrema bispinata n. gen., n. sp.

Paracalitrema acanthocirrus n. gen., n. sp.

Rhombocreadium symmetrorchis n. gen., n. sp.

Dussumieria acuta Cuv. and Val.

Parahemiurus dussumieri n. sp.

Equula daura Cuvier

Hamacreadium equulai n. sp.

Epinephelus chlorostigma (Val.)

Prosorhynchus epinepheli Yamaguti, 1939

Epinephelus undulosus Quoy and Gaimard

Helicometrina septorchis Srivastava, 1936

Prosorhynchus epinepheli Yamaguti, 1939

Fistularia villosa Klunzinger

Stephanostomum adinterruptum n. sp.

Tormopsolus mirzai n. sp.

Gastrophysus spadiceus (Richardson)

Diploproctodaeum plicitum (Linton, 1928) Sogandares and Hutton, 1958

Prosogonotrema pritchardae n. sp.

Gerres filamentosus Cuv. and Val.

Crassicutis karwarensis n. sp.

Decemtestis mehrai Srivastava, 1936

Gymnothorax undulatus (Lacépède)

Dollfustrema sp.

Hemiramphus far (Forskål)

Tergestia laticollis (Rud. 1819) Stossich, 1899

Ilisha filigera (Val.)

Brachadena sp.

Parahemiurus indicus n. sp.

Johnius axillaris (Cuv.)

Helicometrina septorchis Srivastava, 1936

Johnius glaucus (Day)

Helicometrina septorchis Srivastava, 1936

Lethrinus frenatus Val.

Hamacreadium krusadaiensis Gupta, 1956

Hamacreadium mutabile Linton, 1910

Lutianus fulviflamma (Forskål)

Centrovarium marinum n. sp.

Hamacreadium mutabile Linton, 1910

Neometadena lutiani n. gen., n. sp.

Lutianus johnii (Bloch)

Decemtestis mehrai Srivastava, 1936

Helicometrina septorchis Srivastava, 1936

Mehracola ovocaudatum (Srivastava, 1939) Manter, 1947

Metadena karthai n. sp.

Neometadena lutiani n. gen., n. sp.

Lutianus quinquilinearis Bleeker

Hamacreadium mutabile Linton, 1910

Helicometrina septorchis Srivastava, 1936

Lutianus rivulatus (Cuv.)

Hamacreadium mutabile Linton, 1910

Helicometrina septorchis Srivastava, 1936

Megalaspis cordyla (L.)

Lecithocladium megalaspis Yamaguti, 1952

Minous monodactylus (Bl. and Schn.),

Stephanostomum Sp.

Muraenesox cinereus (Forskål)

Stomachicola muraenesocis Yamaguti, 1934

Muraenesox talabonoides Bleeker

Stomachicola muraenesocis Yamaguti, 1934

Narcine timlei Bl. and Schn.

Anaporrhutum albidum Brandes in Ofenheim, 1900

Nemipterus japonicus (Bloch)

Podocotyloides parupenei (Manter, 1963) Pritchard, 1966

Stephanostomum nemipteri n. sp.

Neothunnus macropterus (Schlegel)

Uroproctinella attenuata n. sp.

Otolithus maculatus Cuv.

Erilepturus hamati (Yamaguti, 1934) Manter, 1947

Otolithus ruber (Schn.)

Pleorchis sciaenae Yamaguti, 1938

Pampus argenteus (Euphrasen)

Lepidapedon longivesiculum n. sp.

Parupeneus indicus (Shaw)

Paropecoelus indicus n. sp.

Platycephalus scaber (L.)

Helicometrina septorchis Srivastava, 1936

Prosorhynchus tsengi Tsin, 1933

Tubulovesicula angusticauda (Nicoll, 1915) Yamaguti, 1934

Platycephalus indicus (L.)

Erilepturus hamati (Yamaguti, 1934), Manter, 1947

Helicometrina septorchis Srivastava, 1936

Pomacanthus annularis (Bloch)

Jonesiella pomacanthi n. gen., n. sp.

Pomadasys furcatum (Bloch)

Helicometrina septorchis Srivastava, 1936

Pomadasys hasta (Bloch)

Lasiotocus pomadasi n. sp.

Pseudallacanthochasmus grandispinus Velasquez, 1961

Pomadasys maculatus (Bloch)

Aephenidiogenes senegalensis Dollfus and Capron, 1958

Decemtestis mehrai Srivastava, 1936

Polynemus plebius Broussonet

Erilepturus hamati (Yamaguti, 1934) Manter, 1947

Polynemus tetradactylus Shaw

Erilepturus hamati (Yamaguti, 1934) Manter, 1947

Psettodes erumei (Bloch)

Helicometrina septorchis Srivastava, 1936

Rhipidocotyle septapapillata Krull, 1934

Pseudorhombus diacanthus Bleeker

Pleorchis sciaenae Yamaguti, 1938

Saurida gracilis (Quoy and Gaimard)

Opegaster trachinocephali n. sp.

Scatophagus argus (L.)

Hysterolecitha scatophagi n. sp.

Paradiscogaster farooqii n. sp.

Sciaena aneus (Bloch)

Helicometrina pandei n. sp.

Sciaena sina (Cuv. and Val.)

Helicometrina septorchis Srivastava, 1936

Scolopsis vosmeri (Bloch)

Allobacciger macrorchis n. gen., n. sp.

Serranus diacanthus Cuv. and Val.

Prosorhynchus epinepheli Yamaguti, 1939

Serranus maculatus Bleeker

Helicometrina septorchis Srivastava, 1936

Serranus salmoides (Lacépède)

Prosorhynchus atlanticus Manter, 1940

Serranus waandersi Bleeker

Prosorhynchus epinepheli Yamaguti, 1939

Sillago sihama (Forskål)

Allodecemtestis biacetabulata n. gen., n. comb.

Helicometrina septorchis Srivastava, 1936

Sphyraena picuda Bloch

Didymocystis pseudobranchialis Job, 1964

Stromateus niger (Bloch)

Lecithocladium parviovum Yamaguti, 1952

Tachysurus nenga (Ham.)

Buckleytrema indica Gupta, 1956

Tetrodon lunaris Bl. and Schn.

Diploproctodaeum plicitum (Linton, 1928) Soganderes and Hutton 1958

Opistholebes amplicoelus Nicoll, 1915

Opistholebes cotylophorus Ozaki, 1935

Tetrodonicola biacetabulata n. gen., n. sp.

Tetrodon oblongus Bleeker

Diploproctodaeum anteroporum n. sp.

Tetrodonicola biacetabulata n. gen., n. sp.

Therapon jaruba (Forskål)

Decemtestis brevicirrus Srivastava, 1936

Erilepturus lemeriensis (Tubangui and Masilungan, 1935) Manter, 1947

Helicometrina septorchis Srivastava, 1936

Spelotrema sp.

Therapon puta Cuv. and Val.

Helicometrina septorchis Srivastava, 1936

Podocotyloides parupenei (Manter, 1963) Pritchard, 1966

Therapon theraps Cuv. and Val.

Podocotyloides parupenei (Manter, 1963) Pritchard, 1966

Thrissocles hamiltoni (Gray)

Parahemiurus indicus n. sp.

Thrissocles mystax (Bloch and Schn.)

Bacciger cochinensis n. sp.

Parahemiurus indicus n. sp.

Trachinocephalus myops (Bl. and Schn.)

Opegaster trachinocephali n. sp.

Triacanthus brevirostris Schlegal

Aproctodaeum ovatum n. gen., n. sp.

Transversocreadium cablei n. gen., n. sp.

Upeneus bensasi (Schlegal)

Pseudopecoelina elongata n. sp.

Upeneus sulphureus Cuvier

Dactylostomum sulphurei n. sp.

Upeneus taeniopterus Cuvier

Pseudopecoelina elongata n. sp.

Upeneus tragula Richardson

Dactylostomum sulphurei n. sp.

LIST OF FISHES FOUND NEGATIVE FOR DIGENETIC TREMATODES

Aetobatus narinari (Euphrasen) (3)+

Anchoviella commersonii (Lacépède) (7)

Anchoviella indica van Hasselt (1)

Anguilla bicolor McClelland (2)

Astrape diptergia (Bl. and Schn.) (2)

Batrachus grunniens Bl. and Schn. (1)

Belone choram Rüppell (2)

Belone leiurus Bleeker (2)

Belone melanostigma Cuv. and Val. (1)

Belone strongilura van Hasselt (6)

Caranx affinis Rüppell (1)

Caranx ciliaris (Bloch) (14)

Caranx leptolepis (Cuvier) (2)

Chaetodon lineolatus Cuvier (2)

Chanos chanos (Forskål) (6)

Chatocssus chacunda (Ham. Buch.) (14)

Chilosecylium indicum (Gmelin) (7)

Chrysophrys berda (forskål) (2)

Chrysophrys datina (Ham. Buch.) (1)

Chrysophrys haffra (Forskål) (2)

Chrysophrys sarba (Forskål) (1)

+ The number in parentheses indicates the number of fish examined.

Cybium commersonii (Lacépède) (2)

Cynoglossus brevis Günther (2)

Cynoglossus dispar Day (1)

Cynoglossus elongatus Günther (10)

Cynoglossus oligolepis (Bleeker) (9)

Cynoglossus semifasciatus Day (3)

Diagramma cinctum Schlegel (1)

Diagramma crassispinum Rüppell (2)

Dussumieria hasseltii Bleeker (1)

Echneis naucrates L. (5)

Ephippus orbis (Bloch) (1)

Equula brevirostris Cuv. and Val. (3)

Equula dussumieri Cuv. and Val. (1)

Equula edentula (Bloch) (1)

Equula insidiatrix Cuv. and Val. (6)

Exocoetus comatus Mitchill (1)

Gerres limbatus Cuv. and Val. (2)

Hemiramphus xanthopterus Cuv. and Val. (3)

Ilisha indica (Swainson) (3)

Kowala coval (Cuvier) (2)

Lethrinus nebulosus (Forskål) (1)

Lutianus argentimaculatus (Forskål) (4)

Megalops cyprinoides (Broussonet) (1)

Mene maculata (Bloch) (3)

Mobula diabolus (Shaw) (1)

Mugil cephalus L. (2)

Nebrius conclor Rüppell (1)

Ophiocephalus leucopunctatus Sykes (2)

Opisthopterus tartoor (Cuv. and Val.) (2)

Otolithus argentius Cuv. and Val. (8)

Otolithoides brunneus Cuvier (4)

Pagrus spinifer (Forskål) (1)

Pempheris moluca (Cuvier) (10)

Plagusia bilineata (Bloch) (1)

Platycephalus punctatus Cuv. and Val. (2)

Plotosus arab (Forskål) (1)

Plotosus canius Ham. (2)

Pomadasys argyreus (Cuv. and Val.) (2)

Priacanthus hamrur (Forskål) (2)

Pristis cuspidatus Latham (1)

Pristis microdon Latham (12)

Pteroplatea micrura (Bl. and Schn.) (2)

Rhinobatus granulatus Cuvier (2)

Rhynchobatus djeddensis (Forskål) (1)

Sargus noct (Cuv. and Val.) (1)

Scoliodon acutus Rüppell (1)

Scolopsis bimaculatus Rüppell (2)

Sebastichthys strongia (Cuvier) (2)

Serranus boelang Cuv. and Val. (3)

Serranus boenack (Bloch) (2)

Siganus javus (L.) (7)

Solea ovata Richardson (1)

Stegostoma tigrinum Günther (1)

Synaptura albomaculata Kaup (4)

Synaptura cornuta (Cuvier) (4)

Synaptura orientalis (Bl. and Schn.) (4)

Tetrodon fluviatilis Ham. Buch. (2)

Tetrodon reticularis Bl. and Sch. (1)

Therapon quadrilineatus (Bloch) (3)

Thrissocles purava (Ham. Buch.) (7)

Trygon bleekeri Blyth (1)

Trygon kuhlii Müller and Henle (1)

Trygon sephen (Forskål) (1)

Trygon uarnak Annandale (6)

Trygon zugei Müller and Henle (6)

Trypauchen vagina (Bl. and Schn.) (7)

Upeneus vittatus (Forskål) (23)

Zygyaena blochii Cuvier (2)

Zygaena malleus Shaw (1)

DISCUSSION

General Results:

In the present investigation, out of 225 species of marine fishes of the Bay of Bengal and the Arabian Sea examined, 135 were found positive for Digenea and 90 were negative for them. The present work, however, consists of the study of the Digenea obtained from 89 species of marine fishes. The trematodes from the remaining fishes will be dealt with at a later date. All the trematodes were recovered from teleost fishes with the exception of Anaporrhutum albidum, which was collected from an electric ray, Narcine timlei. The infection of Digenea in selachian fishes has been found to be a rarity. Podocotyloides pedicellatus (Srivastava, 1938) Pritchard, 1966 from Chiloscyllium indicum, a lip shark, from Puri, "must have been acquired with an ingested host", (Pritchard, 1966).

All the trematodes belong to 21 families, distributed among 66 genera, comprising of 89 species, including 3 unassigned species and one larval form. Of these, 42 species including 9 species representing 9 new genera

(excluding unassigned species) are new to science. For already known species, 70 new host records and 66 new records of locality have been noted. After making detailed study of various taxa and conclusions thereform, 2 new combinations (including a known species raised to the status of a new genus) and 5 synonymies have been proposed. Six families viz., Bivesiculidae, Microphallidae, Opistholebetidae, Accacoeliidae, Prosogonotrematidae and Hirudinellidae, although represented by one species each, are reported for the first time from the fishes of the Indian waters.

Column 1, Table II, presents information of the total number of species of Digenea of marine fishes familywise, compiled from the present work as well as from the previous work done in India. Only valid species have been included in this table. Thus in all, 138 species have been found to infect the fishes of the Bay of Bengal and the Arabian Sea. These species are distributed to 21 families and 84 genera. The percentages of each family have been graphically represented in Text Figure 2A. It is obvious that the hemiurids (20.3%) are most abundant in the Indian region. The opecoelids (15.2%) and the bucephalids (14.5%) are also fairly well represented. The fellodistomes (10.2%), the

TABLE II

Geographical Distribution of Digenea of Indian Marine Fishes

Family	Number of Species			
	Total	E. Coast	W. Coast	Both Coasts
Bucephalidae	20	8	10	2
Haplosplanchnidae	3	1	-	2
Bivesiculidae	1	1	-	-
Microphallidae	1	1	-	-
Cryptogonimidae	5	1	3	1
Gorgoderidae	1	1	-	-
Monorchiidae	3	-	3	-
Fellodistomatidae	14	6	8	-
Acanthocolpidae	11	6	3	2
Monascidae	2	1	1	-
Opistholebetidae	3	2	-	1
Opecoelidae	21	17	1	3
Lepocreadiidae	12	3	8	1
Accacoeliidae	1	1	-	1
Monodhelminthidae	3	-	1	2
Isoparorchiidae	1	1	-	-
Prosogonotrematidae	1	-	1	-
Pleorchiidae	1	-	-	1
Didymozoidae	5	5	-	-
Hemiuridae	28	10	14	4
Hirudinellidae	1	-	1	-
Total	138	65	54	19

Text Figure 2 A. Species distribution of Digenea of marine fishes of India.

B. Species distribution of Digenea on the East coast.

C. Species distribution of Digenea on the West coast.

D. Species distribution of Digenea on both the coasts.

The numbers on the abscissa indicate families as follows:

1. Bucephalidae. 2. Haplosplanchnidae. 3. Bivesiculidae.

4. Microphallidae. 5. Cryptogonimidae. 6. Gorgoderidae.

7. Monorchiidae. 8. Fellodistomatidae. 9. Acanthocolpidae.

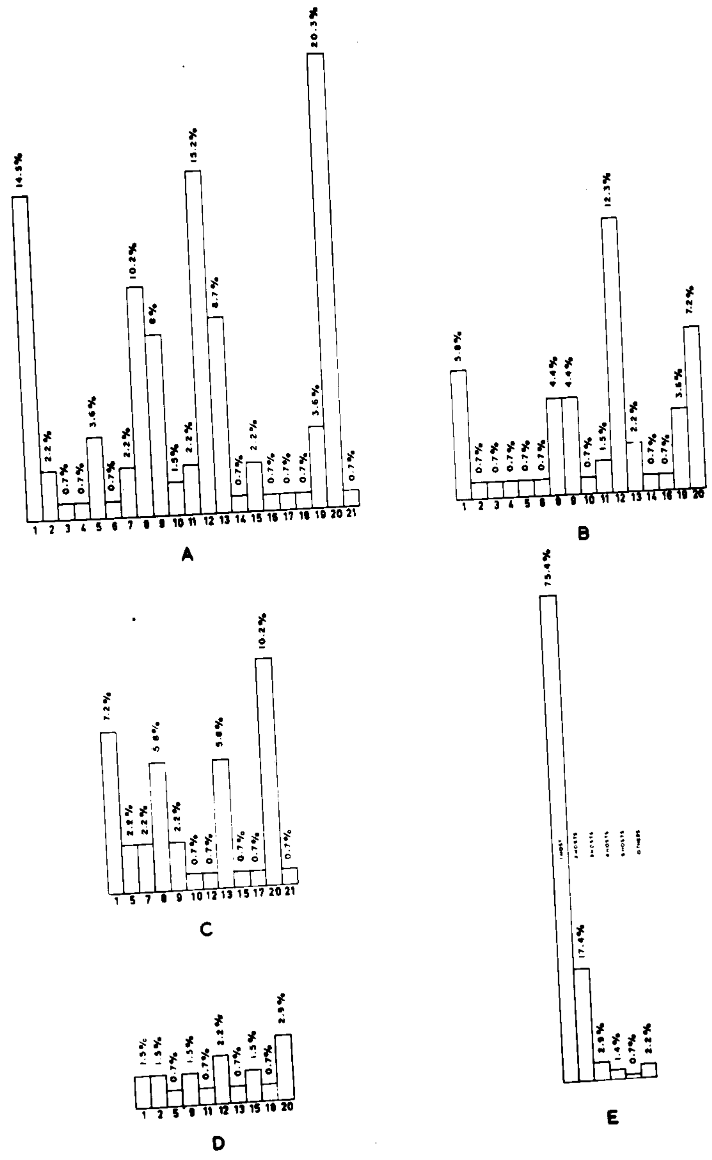
10. Monascidae. 11. Opistholebetidae. 12. Opecoelidae.

13. Lepocreadiidae. 14. Accacoeliidae. 15. Monodhelminthidae.

16. Isoparorchiidae. 17. Prosogonotrematidae. 18. Pleorchiidae.

19. Didymozoidae. 20. Hemiuridae. 21. Hirudinellidae.

Text Figure 2 E. Graphic Representation of Host-specificity of Digenea of Marine Fishes of India.


A
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
14.5% 2.2% 0.7% 0.7% 3.6% 0.7% 2.2% 10.2% 8% 1.5% 2.2% 13.2% 8.7% 0.7% 2.2% 0.7% 0.7% 0.7% 3.6% 20.3% 0.7%
B
1 2 3 4 5 6 8 9 10 11 12 13 14 16 18 20
5.8% 0.7% 0.7% 0.7% 0.7% 0.7% 4.4% 4.4% 0.7% 1.5% 12.3% 2.2% 0.7% 0.7% 3.6% 7.2%
C
1 5 7 8 9 10 12 13 15 17 20 21
7.2% 2.2% 2.2% 5.8% 2.2% 0.7% 0.7% 5.8% 0.7% 0.7% 10.2% 0.7%
D
1 2 5 9 11 12 13 15 18 20
1.5% 1.5% 0.7% 1.5% 0.7% 2.2% 0.7% 1.5% 0.7% 2.9%
E
75.4% 17.4% 2.9% 1.4% 0.7% 2.2%

lecithocreadiids (8.7%) and the acanthocolpids (8%) are next in abundance. The families Bivesiculidae, Microphalidae, Gorgoderidae, Accacoeliidae, Isoparorchidae, Prosogonotrematidae, Pleorchiidae, and Hirudinellidae (all below 1%) are very poorly represented.

Site of Infection:

With few exceptions mentioned below, most digenetic trematodes are usually found to parasitise the intestine of fishes. The hemiurids, however, almost invariably occupy the stomach of fishes. Prosogonotrema pritchardae n. sp., was twice found to infect the esophageal region of Gastrophysus spadiceus but the worm was also obtained from the intestine of Arthias multidens. Elongoparorchis pneumatis Rao, 1961 strictly lives in the swim bladder of Arius jella. Anaporrhutum albidum Brandes in Ofenheim, 1900 infects the body cavity of Narcine timlei. Southwell (1913 b) also collected it from similar location in another selachian fish, Chiloscyllium indicum. Didymocystis pseudobranchialis Job, 1964 has always been found to live in pairs attached on the pseudobranch of Sphyraena picuda. Obviously, the infection of digenetic trematodes in various organs of marine fishes other than the gut is rare.

Zoogeography:

Table II also shows the geographical distribution of 138 Indian species of Digenea familywise on the east and the west coasts. Sixty five species (51 from the present study) are found to occur on the east coast, 54 (47 from the present study) on the west coast and 19 (9 from the present study) occur on both the coasts. Thus only 13.8% of the total number of species of digenetic trematodes infect the fishes of both the seas. These data have been shown in Text Figures 2B, 2C and 2D. The families Microphallidae, Bivesiculidae, Gorgoderidae, Accacoeliidae, Isoparorchiidae, and Lidymozoidae are represented on the east coast, and the families Monorchiidae, Prosogonotrematidae, and Hirudinellidae are represented only on the west coast. None of the Fellodistome and Monascid species occur on both the coasts. Such a low percentage (13.8%) of common species leaves the impression that the fishes of the Bay of Bengal and the Arabian Sea may have their own fairly distinct fauna of digenetic trematodes.

From a perusal of the trematodes found to occur on both the coasts in the present as well as past studies, it will be revealed that most of them are found in the same host species, or related species of the same genus,

or related genera of the same family and sometimes related families as well. It is true for those species also which have been originally described from places other than India. In very few cases the Digenea common to both coasts have been found from one fish on one coast and from an entirely different fish on the other coast. The fish fauna of both seas of India does not seem to be much different from each other and the east and the west coastlines are continuous via Palk Bay and Gulf of Manaar. The Palk strait is not a barrier to the movement of the fishes. One may naturally expect similar fauna of Digenea of the fishes of both the seas, but this has not come to be so as a result of the present and past studies (the occurrence of digenetic trematodes found in the fishes of both the waters being as low as 13.8%). A probable explanation to this distinctness of the fauna of Digenea of the fishes of both the waters may be found in the variety and distinctness of molluscan fauna and some ecological factors which may be different in both the seas.

Of the known species (47 in number) recorded in this study, the following 25 species have been described from places other than Indian waters:

1. Pseudocreadium patellare Yamaguti, 1938

2. Prosorhynchus epinepheli Yamaguti, 1939
3. Stomachicola muraenesocis Yamaguti, 1934
4. Pleorchis sciaenae Yamaguti, 1938
5. Opsitholebes cotylophorus Ozaki, 1935
6. Erilepturus lemeriensis (Tub.and Masi.,1935) Manter, 1947
7. Prosorhynchus chorinemi Yamaguti, 1952
8. Lecithocladium megalspis Yamaguti, 1953
9. Pseudollacanthochasmus grandispinus Velasquez, 1961
10. Opistholebes amplicoelus Nicoll, 1915
11. Monascus tylicus (Odhner, 1911)
12. Diplomacroctodaeum plicitum (Linton, 1928) Sogandares and Hutton, 1958
13. Anaporrhutum albidum Brandes in Ofenheim, 1900
14. Hamacreadium mutabile Linton, 1910
15. Prosorhynchus tsengi Tsin, 1933
16. Prosorhynchus atlanticus Manter, 1940
17. Tetrochetus coryphaenae Yamaguti, 1934
18. Erilepturus hanati (Yamaguti, 1934), Manter, 1947
19. Tubulovesicula angusticauda (Nicoll, 1915) Yamaguti, 1934
20. Lecithocladium parviocum Yamaguti, 1953
21. Hymenocotta mulli Manter, 1961
22. Acanthocolpus tenuis Manter, 1963
23. Bacciger nicolli Palombi, 1934

24. Potocotyloides parupenei (Manter, 1963) Pritchard, 1966
25. Rhipidocotyle septapapillata Krull, 1934

A mere perusal of the places of occurrence of the species listed above reveals that the digenetic trematode fauna of the marine fishes of India has some species in common with those of the marine fishes of Japan, the Philippines, and Celebes, whereas the species of New Zealand, Australia and Tasmania are either very poorly represented in Indian waters or are absent altogether. This dissimilarity between the digenetic trematode faunas of the two regions may be due to space, differences in temperatures and other ecological factors, as well as differences in the feeding habits of the fishes around these places. This list also shows that the digenetic trematode fauna of the marine fishes of India is distinctly dissimilar to those of other regions of the world.

Host-specificity:

In its strict sense host-specificity is a rigid phenomenon and involves special adaptation of the parasite to a particular host which is sometimes called as the immediate environment or the microenvironment of the parasite. It is also determined by the macroenviron-

ment of the parasite i.e., the environment in which the host of the parasite lives. The ecological factors also influence the host-specificity. With the change in ecological conditions the parasites may gradually change its host although such a change takes place over a long period of time. If a parasite is strictly specific and adapted to only a particular host species or group of species then, this specialisation of the parasite in relation to its host is described as absolute specificity. But as such absolute specificity does not exist in nature because, according to Shulman (in Dogiel et al, 1958) specificity "is not something moulded or fixed for all time. In the course of evolution it continues to change and develop" under changing conditions of life of both the parasite and the host. Therefore, a parasite may become adapted to a group of closely related hosts and the phenomenon may be less rigid and stable then, this condition of host-parasite relationship may be termed as relative specificity. In fact, absolute specificity is also relative, but the difference between the two phenomena is not of kind, it is one of degree of stability in and narrowness of adaptation to the host or hosts. Sometimes the bond of specificity of the parasite to the host is so loose that the parasite infects unrelated hosts or

only very distantly related hosts then, this condition may be known as loose or intermittent specificity.

It was generally believed that the Digenea of marine fishes do not exhibit high degree of host-specificity. During recent years the trematode fauna of various parts of the world have become more thoroughly known than ever and it has been revealed that the Digenea of marine fishes do exhibit fairly high degree of host-specificity. The Digenea which show strict host-specificity live in various organs of the host body other than the gut. Loose specificity is, no doubt, very commonly met with. Such parasites generally infect the gut of the fishes. According to Shulman (1958), "The parasites infesting the gut are usually less strictly specific than the mature parasites of other organs. Their specificity is farily unstable, enabling them, under the influence of various factors, especially the feeding habits of the hosts, to infest other species relatively easily."

In the light of the foregoing discussion and considerations, the nature and degree of host-parasite relationship exhibited by the Digenea of the fishes of the Bay of Bengal and the Arabian Sea can be seen by citing suitable examples from the present study.

Elongoparorchis pneumatis Rao, 1961, an isoparorchiid, strictly lives in the swim bladder of Arius jella and was described from Visakhapatnam. In the present study also this trematode was not found anywhere else in any other fish, either from the rest of the east coast or from the entire west coast, although many other species of cat-fishes were examined. In fact, no other trematode was found to occur in the swim bladder of fishes in the present investigation. Job (1961-1966) described five didymozoids which infect various species of the fish genus Sphyraena only in the Bay of Bengal. One of them, Didymocystis pseudobranchialis Job, 1964 has also been recorded in the present work from the pseudobranch of Sphyraena picuda. This has not been found to occur in any other fish so far. These two examples illustrate absolute specificity in the digenetic trematodes of the marine fishes of India. The host-specificity and the distribution of the five didymozoids from India have been discussed at length by Job (1966).

Monascus typicus (Odhner, 1911) was described from Caranx trachurus from Palermo, Trieste. Fischthal and Kuntz (1963) reported and redescribed it from Decapterus russelli, a carangid, and Hydrocyon forskalii, a characid, from Egypt. Janiszewska (1953) recorded it

(as Haplocladus typicus) in Trachurus trachurus and T. mediterraneus from the Adriatic Sea. Fischthal and Thomas (1968) reported it from Decapterus rhonchus, Selar crumenophthalmus and Chloroscombrus chrysurus, all carangid fishes, from Ghana. Obviously, Monascus typicus, although quite widely distributed, is strictly specific to carangid fishes and rarely to a characid fish. Monascus orientalis (Srivastava, 1941) was described from Synaptura orientalis, a sole, from the Bay of Bengal. This species has also been collected by Siddiqi (unpublished) from Chloroscombrus chrysurus, Alepes amblyrhynchus and Caranx senegalensis at Lagos, Nigeria. It may be deduced from this information that M. orientalis also has a propensity to infect carangid or related fishes. Unrelated fishes like Synaptura orientalis do not appear to be the proper host for this trematode. It may be a case of accidental parasitism. Another example of relative specificity may be cited by the various species of Dollfustrema Eckmann, 1934 under which an unassigned species has been described in this work. These species of Dollfustrema are:

1. Dollfustrema vaneyi, Tseng Shen, 1930, in Spiniperca scherzeri
2. D. echinatum (Komiya and Tajimi, 1941), in Pseudorasbora parva

3. D. gavidum Manter, 1940, in Gymnothorax moringa,

4. D. macrocanthum Hanson, 1950, in Gymnothorax moringa,

5. D. californae Montgomery, 1957, in Gymnothorax mordax,

6. D. muraenae Sogandares- Bernal, 1957, in Gymnothorax visinis,

7. Dollfustrema sp. (present sstuy) in Gymnothorax undulata.

It is obvious from the above list that the species of Dollfustrema predominantly infect the species of the fish genus Gymnothorax.

The host-specificity and the distribution of the various species of Crassicutis Manter, 1936 may be of some interest. Crassicutis karwarensis n. sp. from Gerres filamentosus from the Arabian Sea is very closely allied to C. marina Manter, 1947 from Eucinostomus lefroyi and Gerres cinereus from Tortugas, Florida. This has also been recorded from G. cinereus from Jamaica and Bimini, British West Indies. Manter (1966) has also collected a species of Crassicutis (unpublished) from Australia from a species of Gerres similar to a species of Crassicutis described from a species of Gerres from the Caribbean. The other valid species of Crassicutis are: C. cichlasomae Sparks and Thatcher, 1960, from Archosargus probatocephalus from Grand Isle,

Lousiana, Northern Gulf Of Mexico; C. opisthoseminis Bravo and Arrayo, 1962 from Cichlasoma sp. from the N. Pacific and C. gerridis Nahas and Cable, 1964 from Gerres cinereus from Curacao and Jamaica. The above is indicative of the fact that Crassicutis are rather strictly specific mainly to genus Gerres. From the distribution of the various species of Crassicutis one may assume that the genus originated in the Caribbean or in the vicinity thereof and later become dispersed to the Arabian Sea and the Australian waters. But the actual pathway of dispersal is difficult to speculate. Probably it is associated with the origin and dispersal of the host fishes themselves.

The family Opistholebetidae in the present study comprises of Tetrodonicola biacetabulata n. gen., n. sp. from Tetrodon lunaris and T. oblongus; Opistholebes amplicoelus Nicoll, 1915 and O. cotylophorus Ozaki, 1935, both from Tetrodon lunaris. The various species of the fish genus Tetrodon do harbour other Digenea also but obviously, the opistholebetids show preference for them.

TABLE III

Host-specificity of Digenea of Indian Marine Fishes

1-host species	2-host species	3-host species	4-host species	5-host species	Several-host species	Total
104	24	4	2	1	3	138
or	or	or	or	or	or	
74.4%	17.4%	2.9%	1.4%	0.7%	2.2%	

This table does not incorporate the host fishes of the known species of the Digenea described and recorded from elsewhere. Two-host, three-host and four-host species of the trematodes infect related or unrelated fishes belonging to the same genus or different genera. Hamacreadium mutabile, a five-host species, has been obtained only from the snappers belonging to closely related families. Among the several host-species, Lepocreadioides indicum, was recovered from seven different species of Cynoglossus. Originally it was described from Platycephalus scaber. Helicometrina septorchis is a several-host species (vide Table I) and has been found in 10 genera of fishes, of which some are closely related, while others are definitely unrelated. This picture of host-specificity among the Digenea of

the Indian waters has been graphically shown in Text Figure 2E. The number of polyxenous Digenea in the Indian region is small. Thus, the degree of host-specificity in them is fairly high as is the case in Tortugas, Florida and Japan. The fact that these digenetic trematodes are fairly host-specific is also evident by the knowledge of the fish hosts of the trematodes which have been described from other parts of the world, and have been recorded from the Indian waters also. A possible reason for this high degree of host-specificity and small number of polyxenous trematodes may be that progenesis may not have taken place in the Digenea of the fishes of the Indian waters. A comparision of these results and that of the trematodes of Japan as given by Manter (1947) reveals striking similarity between the two in the pattern of host-specificity.

The new host records show that some digenetic trematodes originally described from a marine fish of India have been collected from a different fish or fishes in the present investigation. Such cases are met with in the trematodes of the gut only. It is quite likely that still new fish hosts may be recorded for known trematodes by future investigators in India. In that event the picture of the degree of host-specificity as

provided in Table III and Text Figure 2E shall change in due course. In this context weightage is to be given to the idea of accidental parasitism distinct from specificity. The presence of a parasite in a host may not necessarily be due to specificity only. It may be due to accidental parasitism as well, happening circumstancially under the forces of certain factors prevailing in the surrounding. It is a 'static' phenomenon materialization of which does not involve the forces of propensity of the parasite to live in a host, whereas specificity is a 'kinetic' phenomenon which takes place by the forces of propensity intrinsic in the parasite itself to live in a particular host. It so appears that the concept of accidental parasitism or 'occurence' of a parasite in a host is consistent with the popular belief that parasitism is a chance phenomenon. It may also be the first step on the ladder of specificity.

CONCLUSIONS

About 60% of the fishes of the Bay of Bengal and the Arabian Sea have been found to harbour Digenea but there is every likelihood that the fishes negative for these flukes (about 40%) may be found infected with them in future, if examined still more extensively and exhaustively. About 15,000 species of fishes are on record in the Indian waters and there may be more unrecorded ones. Of these, only 225 species of fishes have been examined in the course of this study. According to Manter (1966), "----------there are nearly as many species of trematodes in fishes as there are species of fishes (some 25,000 to 30,000 species)". Therefore, even if one species of Digenea infects one fish, there ought to be about 1,500 or more species of Digenea infecting the fishes of the Bay of Bengal and the Arabian Sea. Whereas only 138 species of Digenea have been described or recorded so far, almost all of them from teleost fishes. A large number of selachian fishes were, however, examined but only Narcine timlei was found positive. Hence infection of Digenea in selachian fishes in the seas of India is rather rare.

Of the 21 families of Digenea of marine fishes

recorded, Hemiuridae, Bucephalidae, Opecoelidae and Lepocreadiidae are in abundance while Microphallidae, Isoparorchiidae, Gogoderidae, Accacoeliidae and Hirudinellidae are poorly represented in Indian waters. In addition to describing new species of digenetic trematodes, an approximately equal number of the known species have also been recorded. Small number of synonymies and new combinations in the present study suggest that the status of taxa of Digenea in Indian waters is fairly stable.

The known alien species of trematodes recorded here for the first time in large numbers show that the fauna of Digenea of the fishes of India bear some similarity to those of Japan, the Philippines and Celebes, and is distinctly dissimilar to those of Australia, New Zealand, Tasmania and other parts of the world. It also shows that the Digenea of marine fishes of India are not only indigenous but some species described from other parts of the world are also not uncommon in Indian waters.

The trematodes obtained from organs other than the gut show strong host-specificity. The number of polyxenous trematodes is very small showing that progenesis in the flukes of the marine fishes of India is not common. In general, the Digenea of this region

show high host-specificity as is the case in Japan and in Tortugas, Florida.

As a result of; the work already done in India and the present investigation, it is evident that the fishes of the Bay of Bengal and the Arabian Sea appear to be quite rich in digenetic trematode fauna and, therefore, present good scope for studying various problems of fish parasitology which have not even been initiated in India. In fact, such work has not been done in most other parts of the world. Recently, Manter (1947, 1954, 1955, 1966, 1967) has dealt with some aspects of it. The Russian parasitologists, like Dogiel et al (1958) [English translation by Kabata, 1961], no doubt, have done commendable work in this direction but their work is limited to Russian waters only. The present work, although extensive in its nature, still appears to be preliminary. In future, in addition to the taxonomy, their biology, physiology, ecology, zoogeography and host-parasite relationship etc., should also be studied, The multifarious information on these parasites, the corelationship of such information and their comparision with those of the parasites of other regions of the world, may be useful in understanding the evolution of the parasites and their hosts, the geological, palaeontological and ancient

geographical conditions of the region concerned, and also in deriving any parasitological generalisations.

SUMMARY

The digenetic trematodes were collected from the fishes of the Bay of Bengal and the Arabian Sea at the following places: Visakhapatnam (including Waltair), Madras, Mandapam, Tuticorin, Cochin, Calicut, Karwar, Bombay and Veraval. About 225 species of fishes were examined, out of which 135 harboured Digenea and 90 species were found negative for them. Eighty nine species of the Digenea from 89 species of fishes have been described or recorded in the present work. The flukes from the remaining species of fishes could not be studied due to one reason or the other. These trematodes comprise of 42 new species, 10 new genera, 47 known species both from India and elsewhere; 3 unassigned species, one larval form, 5 synonymies, 2 new combinations, one new name and 70 new host records.

The new species described are:

Alcicornis thapari

Allobacciger macrorchis

Aphanurus acanthophallus

Apenurus drepani

Aproctodaeum ovatum

Bacciger cochinensis

Bivesiculoides callyodoni

Calitrema bispinata

Centrovarium marinum

Crassicutis karwarensis

Dactylostomum sulphurei

Diploproctodaeum anteroporum

Faustula basiri

Hamacreadium equulai

Helicometrina pandei

Hysterolecitha scatophagi

Jonesiella pomacanthi

Lasiotocus pomadasi

Lepidapedon longivesiculum

Lepidapedon manteri

Metadena karthai

Neometadena lutiani

Opegaster paramacrorchis

Opegaster trachinocephali

Paracalitrema acanthocirrus

Paradiscogaster farooqii

Parahemiurus brevisinus

Parahemiurus dussumieri

Parahemiurus indicus

Paropecoelus indicus

Plagioporus longicaudus

Prosogonotrema pritchardae

Pseudopecoelina elongata

Pseudopecoeloides chorinemi

Rhombocreadium symmetrorchis

Stephanostomum adinterruptum

Stephanostomum attenuatum

Stephanostomum nemipteri

Tetrodonicola biacetabulata

Tormopsolus mirzai

Transversocreadium cablei

Uroproctinella attenuata

The new genera proposed are:

Neometadena

Allobacciger

Calitrema

Jonesiella

Paracalitrema

Aproctodaeum

Rhombocreadium

Transversocreadium

Allodecemtestis

Tetrodonicola

The unassigned species are:

Brachadena sp.

Dollfustrema sp.

Spelotrema sp.

The larval form is:

Stephanostomum sp.

The synonymies proposed are:

Cainocreadoides Nagaty, 1956; synonym of Hamacreadium Linton, 1910,

Hamacreadium lieperi Gupta, 1956; synonym of H. mutabile Linton, 1910,

Helicometrina orientalis Srivastava, 1936; synonym of H. septorchis Srivastava, 1936,

Decemtestis parapercis Yamaguti, 1959; synonym of D. callyonomi Yamaguti, 1934,

Decemtestis sillagonis Yamaguti, 1934; synonym of D. azumae (Layman, 1930) Yamaguti, 1934.

Cainocreadoides epinepheli (Yamaguti, 1934) has been transferred back to Hamacreadium restoring its original name H. epinepheli.

Acanthocolpus lühei Srivastava, 1939 which was synonymised with A. liodorus Lühe, 1906 has been revalidated.

The new combinations suggested are:
Allodecemtestis biacetabulata for Decemtestis biacetabulata Srivastava, 1936,
Allodecemtestis pseudolabri for Decemtestis pseudolabri Manter, 1954.

The new name proposed is:
Hamacreadium abdelaali for Cainocreadoides serrani, Nagaty, 1956.

Keys to the species of the following genera have been furnished:
Decemtestis Yamaguti, 1934 (Opecoelidae),
Diploproctodaeum LaRue, 1926 (Lepocreadiidae),
Lepidapedon Stafford, 1904 (Lepocreadiidae)
Paropecoelus Pritchard, 1966 (Opecoelidae)
Prosogonotrema Pérez Vigueras, 1940 (Prosogonotrematidae),
Tormopsolus Poche, 1926 (Acanthocolpidae)

The genus Decemtestis Yamaguti, 1934 has been reviewed and splitted into two genera, Decemtestis and Allodecemtestis n. gen. The genera Hamacreadium Linton, 1910, Helicometra Odhner, 1902, and the validity of

their respective allied genera have been discussed.

A host-parasite list and a list of the fishes found negative for the Digenea have been presented.

It has been found that the Digenea of marine fishes of the Bay of Bengal and the Arabian Sea are fairly distinct with only 13.8% of them occurring in the fishes of both the coasts. The record of the known species of Digenea from the Indian marine fishes described from other parts of the world show that the Digenea of marine fishes of India have some species in common with those of Japan, the Philippines and Celebes, It is strikingly different from those of Australia, New Zealand and Tasmania. On the whole Digenea of Indian marine fishes are distinctly dissimilar from those of other parts of the world. The degree of host-specificity manifested by these trematodes is also fairly high.

REFERENCES

Bravo-Hollis, M., and H.W. Manter. 1957. Trematodes of marine fishes of mexican waters. X. Thirteen Digenea, including nine new species and two new genera, from the Pacific Coast. Proc. helminth. Soc. Wash. 24(1), 35-48.

Caballero y C.E. 1946. Un nuevo género de tremátodes de los peces marinos del Puerto de Salina Cruz, Oaxaca, México. An. Inst. Biol. Univ. Méx. Vol. XVII. (1y2), 167-174.

Caballero y C.E. 1952. Revisión de los géneros y especies que integran la familia Acanthocolpidae Lühe, 1909. Revta. Med. vet Parasit., Caracas. XI (1y2), 231 pp.

Chauhan, B.S. 1943. Trematodes from Indian marine fishes. Part II. On some trematodes of the gasterostome family Bucephalidae (Braun, 1883) Poche, 1907, with description of four new species. Proc. Indian Acad. Sci. 17(4), 97-117.

Chauhan, B.S. 1943. Trematodes from Indian marine fishes. Part III. Description of a new species of the genus Mehratrema (Family Monodhelminthidae Dollfus, 1937). Proc. Indian Acad. Sci. 17(5),

133-137.

Chauhan, B.S. 1945. Trematodes from Indian marine fishes. Part IV. On some trematodes of the family Hemiuridae Lühe, 1901, with description of six new forms. Proc. Indian Acad. Sci. 21(3), 160-173.

Chauhan, B.S. 1954. Studies on the trematode fauna of India. Part I. Subclass Monogenea; Part II. Subclass Aspidogastrea; Part III. Subclass Digenea (Gasterostomata); Part IV. Subclass Digenea (Prosostomata). Rec. Indian Mus. 51, 113-393.

Day, F. 1958. The Fishes of India. Vol. I & II.

Deelman, J.J. 1960. Studies on genus Helicometrina Linton, 1910 (Trematoda:Digenea:Allocreadiidae). J. Parasit. 46(5), Sect. 2.

Dogiel, V.A., G.K. Petrushevski, and Yu. I. Polyanski, 1958 Parasitology of Fishes. (English translation by Z. Kabata, 1961) London, Oliver & Boyd Ltd. pp. 384.

Dollfus, R. Ph., and A. Capron. 1958. Un Acphnidiogenes (Trematoda:Digenea) Chez un Labrax (Serranidae) du Sénégal. Bull. Inst. Fr. Afr. Noire. Sér. A, Sci. Nat. 20, 311-319.

Durio, W.O., and H.W. Manter, 1968. Some Digenetic Trematodes of marine fishes of New Caledonia.

Part I. Bucephalidae, Monorchiidae and some smaller families. Proc. helminth. Soc. Wash. 35(2), 143-153.

Fischthal, J.H., and R.E. Kuntz. 1963. Trematode parasites of fishes from Egypt. Part IV. A redescription of Monascus typicus (Odhner, 1911) (Fellodistomidae). Proc. helminth. Soc. Wash. 30(2), 177-182.

Fischthal, J.H., and R.E. Kuntz. 1964. Digenetic trematodes of fishes from Palawan Island, Philippines Part II. Five opecoelids, including three new species. Proc. helminth. Soc. Wash. 31(1), 40-46.

Fischthal, J.H., and R.E. Kuntz. 1965. Digenetic trematodes of fishes from North Borneo (Malaysia). Proc. helminth. Soc. Wash. 32(1), 63-71.

Fischthal, J.H., and J.D. Thomas. 1968. Digenetic trematodes of some freshwater and marine fishes from Ghana. Proc. helminth. Soc. Wash. 35(2), 126-140.

Fischthal, J.H., and J.D. Thomas. 1968. Digenetic trematodes of marine fishes from Ghana. Families Acanthocolpidae, Bucephalidae, Didymozoidae. Proc. helminth. Soc. Wash. 35(2), 237-247.

Gupta, N.K. 1956. Studies on the digenetic trematodes of marine fishes from the Gulf of Manaar (India). Res. Bull. Panjab Univ. Sci. No. 89, 61-63.

Hopkins, S.H. 1941. The genera and species of the family Monorchiidae (Trematoda), with a discussion of the excretory system. J. Parasit. 27(5), 395-407.

Job, S.V. 1961. New record of a digenetic trematode of the family Didymozoidae. The Presidency College Zoology Magazine. Vol. VIII, 12-14.

Job, S.V. 1961. A new record of a digenetic trematode of the genus Platocystis (Family:Didymozoidae). J. Zool. Soc. India. 13(2), 143-147.

Job, S.V. 1961. Didymozoon tetragynae: A digenetic trematode of the family Didymozoidae. J. Madras Univ. B. XXXI No. 3, 311-314.

Job, S.V. 1964. Description of a new species of digenetic trematode (Family:Didymozoidae) and some histochemical observations on the same. Proc. Indian Acad. Sci. 60(2) Sec. B. 128-134.

Job, S.V. 1966. Studies on some Digenea of the family Didymozoidae. Proc. Indian Acad. Sci. LXIV (4), 182-189.

Lamothe, A.R. 1962. Redescription de dos trematodos digeneos de peces del Pacifico Mexicano. An. Inst. Biol. Univ. Méx. XXXIII (1y2), 97-111.

Manter, H.W. 1933. The genus Helicometra and related trematodes from Tortugas, Florida. Pap. Tortugas Lab. 28(11), 167-182.

Manter, H.W. 1934. Some digenetic trematodes from deep-water fish of Tortugas, Florida, Carn. Inst. Wash. Pbls. 435, 257-345.

Manter, H.W. 1940. Digenetic trematodes of fishes from the Galapagos Islands and the neighbouring Pacific. Rep. Allan Hancock Pacif. Exp. 2(14), 325-497.

Manter, H.W. 1947. The digenetic trematodes of marine fishes of Tortugas, Florida. Am. Midl. Nat. 38(2), 257-416.

Manter, H.W. 1954. Some digenetic trematodes from the fishes of New Zealand. Trans. R. Soc. N. Z. 82(2), 475-568.

Manter, H.W. 1955. The zoogeography of trematodes of marine fishes. Expl. Parasit. 4(1), 62-86.

Manter, H.W. 1961. Studies on digenetic trematodes of fishes of Fiji. I. Families Haplosplanchnidae, Bivesiculidae, and Hemiuridae. Proc. helminth. Soc. Wash. 28(1), 67-74.

Manter, H.W. 1963. Studies on digenetic trematodes of fishes of Fiji. II. Families Lepocreadiidae, Opistholebetidae, and Opecoelidae. J. Parasit.

49(1) 99-113.

Manter, H.W. 1963. Studies on digenetic trematodes of fishes of Fiji. III. Families Acanthocolpidae, Fellodistomatidae, and Cryptogonimidae. J. Parasit. 49(3), 443-450.

Manter, H.W. 1966. Parasites of fishes as Biological *Indicators of Recent and Ancient Conditions*. Proc. 26th Annu. Biol. Colloquium on Host-parasite Relationship. pp. 59-71.

Manter, H.W. 1967. Some aspects of the geographical distribution of parasites. J. Parasit. 53(1), 1-9.

Manter, H.W., and M.H. Pritchard. 1960. Some hemiurid trematodes from Hawaiian fishes. Proc. helminth. Soc. Wash. 27(1), 87-102.

Manter, H.W., and M.H. Pritchard. 1960. Additional hemiurid trematodes from Hawaiian fishes. Proc. helminth. Soc. Wash 27(2), 165-180.

Manter, H.W., and M.H. Pritchard. 1960. Some digenetic trematodes of eels of Hawaii. J. Parasit. 46(5), 651-658.

Manter, H.W., and M.H. Pritchard. 1961. Studies on digenetic trematodes of Hawaiian fishes:families Monorchiidae and Haploporidae. J. Parasit. 47(3), 483-492.

Manter, H.W., and M.H. Pritchard. 1962. Studies on digenetic trematodes of Hawaiian fishes:families Fellodistomatidae, Opistholebetidae, and Gyliauchenidae. Trans. Am. Microsc. Soc. 81(2), 113-123.

Manter, H.W., and H.J. VanCleave. 1951. Some digenetic trematodes, including eight new species, from marine fishes of La Jolla, Calif. Proc. U.S. natn. Mus. 101(3279), 315-340.

Margolis, L. 1958. A new species of Lecithophyllum from North Pacific fishes with a consideration of the taxonomy of the genera Lecithophyllum, Aponurus and Brachadena (Trematoda:Hemiuridae). Can. J. Zool. 36, 893-904.

Martin, W.E. 1960. Hawaiian helminths. II. Dactylostomum caballeroi n. sp. (Trematoda: Opecoelidae). Libro Homenaje Caballero y Caballero. pp. 203-205.

Munro, I.S.R. 1955. Marine and fresh water fishes of Ceylon. Published by Department of External Affairs, Canberra, Australia.

Nagaty, H.F. 1937. Trematodes of fishes from the Red Sea. Part 1. Studies on the Family Bucephalidae Poche, 1907. Egypt. Univ. fac. med. Pbls. 12, 172 pp.

Nagaty, H.F. 1954. Trematodes of fishes from the Red Sea. Part 5. On three new opecoelids and one mesometrid. J. Parasit. 40(4), 367-371.

Nagaty, H.F. 1956. Trematodes of fishes from the Red Sea. Part 7. On two gyliauchenids and three allocreadozoids, including four new species. J. Parasit. 42(5), 523-527.

Nagaty, H.F. 1957. Trematodes of fishes from the Red Sea. Part 8. Five species in the families Schistorchidae, Acanthocolpidae, and Heterophyidae. J. Parasit. 43 (2), 217-220.

Nagaty, H.F., and T.M. Abdel Aal.1962. Trematodes of fishes from the Red Sea. Part 15. Four new species of Hamacreadium (family Allocreadiidae). J. Parasit. 48(3), 384-386.

Nahhas, F.M., and R.M. Cable. 1964. Digenetic and Aspidogastrid trematodes from marine fishes of Curacao and Jamaica. Tulane Stud. Zool. 11(5), 169-228.

Noble, A.E., and J.T. Park. 1937. Helicometrina elongata n. sp. from the gobiesocid fish Caularchus meandricus with an emended diagnosis of the trematode genus Helicometrina. Trans. Am. Microsc. Soc. 56(3), 344-347.

Park, J.T. 1939. Fish trematodes from Tyosen. II. Some new digenetic trematodes from marine fishes. Keizyo J. Med. 10(1), 7-8.

Pérez Vigueras, I. 1940. Prosogonotrematidae n. fam. Prosogonotrema bilabiatum n. gen., n. sp. (Trematoda, Distoma), Parasito de Oxyurus chrysurus (Bloch), (Pisces). Mems. Soc. Cub. Hist. nat. Felipe Poey' 14(3), 249-252.

Pritchard, M.H. 1966. A revision of the genus Podocotyle (Trematoda:Opecoelidae). Zool. Jb. Syst. 93, S. 158-172.

Pritchard, M.H. 1966. Studies on digenetic trematodes of Hawaiian fishes:family Opecoelidae Ozaki, 1925. Zool. Jb. Syst. 93, S. 173-202.

Shulman, S.S. 1958. Specificity of Fish Parasites. pp. 104-116. In Parasitology of Fishes (in Russian) Edited by Dogiel et al (English Translation by Z. Kabata, 1961). pp. 384.

Siddiqi, A.H., and R.M. Cable, 1960. Digenetic trematodes of marine fishes of Puerto Rico. N. Y. Acad. Sci., Sci. Survey Porto Rico. 17(3), 258-368.

Skrjabin, K.I. 1947-1962. Trematodes of animals and man (in Russian). Vols. 1-20, U.S.S.R. Academy of Science (Moscow).

Sogandares-Bernal, F. 1959. Digenetic trematodes of marine fishes from the Gulf of Panama and Bimini, British West Indies. Tulane Stud. Zool. 7(3), 69-117.

Sogandares-Bernal, F., and R.F. Hutton. 1958. The status of trematode genus Bianium Stunkard, 1930, a synonym of Diploproctodaeum Lühe, 1926. J. parasit. 44(5), 566-567.

Sogandares-Bernal,F., and R.F. Hutton. 1959. Studies on helminth parasites from the coast of Florida. IV. Digenetic trematode of marine fishes of Tampa, Boca, Ciega Bays and the Gulf of Mexico. Q. Jl. Fla.Acad. Sci. 21(3), 259-273.

Sogandares,F., and L.M. Sogandares. 1961. Nine digenetic trematodes of marine fishes from the Atlantic Coast of Panama. Tulane Stud. Zool. 8(5), 141-153.

Sparks, A.K., and V.E. Thatcher. 1958. A new species of Stephanostomum (Trematoda, Acanthocolpidae) from marine fishes of the North Gulf of Mexico. Trans. Am. Microsc. Soc. LXXVII (3), 287-290.

Srivastava, H.D. 1935. New parasites of the genus Orientophorus n.gen. (Family Fellodistomidae) from an Indian fresh water fish, Clupea ilisha. Parasitology. 27(3), 374-382.

Srivastava, H.D. 1936. New hemiurids (Trematoda) from Indian marine fishes. Part I. A new parasite of the subfamily Prosorhinae Yamaguti, 1934. Proc. natn. Acad. Sci. India. 6(2), 175-178.

Srivastava, H.D. 1936. New allocreadiids (Trematoda) from Indian marine fishes. Part I. "New parasites of the genus Helicometrina Linton, 1910". Proc. natn. Acad. Sci. India. 6(2), 179-185.

Srivastava, H.D. 1936. New allocreadiids (Trematoda) from Indian marine fishes. Part II. New parasites of the genus Decemtestis Yamaguti, 1934. Proc. natn. Acad. Sci. India. 6(3), 187-195.

Srivastava, H.D. 1938. Studies on the gasterostomatous parasites of Indian food-fishes. Indian J. vet. Sci. 8(4), 317-340.

Srivastava, H.D. 1938. Studies on the amphistomatous parasites of Indian food fishes. Part II. New parasites of the genus Gyliauchen Nicoll from the intestine of an Indian marine fish. Indian J. vet. Sci. 8(4), 399-401.

Srivastava, H.D. 1938. New allocreadiids (Trematoda) from Indian marine food fishes. Part III. Pedunculoacetabulum pedicellata n. sp. from the gut of Chiloscyllium indicum. Indian J. vet. Sci.

8(4), 403-405.

Srivastava, H.D. 1939. Two new parasites of the genus Aporurus Looss, 1907 (Subfamily Lecithasterinae). Indian J. vet. Sci. 9(1), 31-35.

Srivastava, H.D. 1939. The morphology and systematic relationship of two new distomes of the family Haplosplanchnidae Poche, 1926, from an Indian marine food fish. Indian J. vet. Sci. 9(1), 67-71.

Srivastava, H.D. 1939. A new parasite of the genus Hysterolecitha Linton, 1910. Indian J. vet. Sci. 9(1), 73-76.

Srivastava, H.D. 1939. A new parasite - Stomachicola secondus of the subfamily Dinurinae Looss, 1907. Indian J. vet. Sci. 9(1), 77-79.

Srivastava, H.D. 1939. New fellodistomids (Trematoda) from Indian hosts. Part II. Three new parasites of the subfamily Discogasteroidinae from Indian marine food fishes. Indian J. vet. Sci. 9(1), 91-95.

Srivastava, H.D. 1939. The morphology and systematic relationship of a new genus of digenetic trematode belonging to the family Monodhelmidae (Dollfus, 1937). Indian J. vet. Sci. 9(1), 97-99.

Srivastava, H.D. 1939. The morphology and systematic relationships of a new parasite Waretrema piscicola gen. et sp. nov., referable to a new family - Waretrematidae- of digenetic trematodes. Indian J. vet. Sci. 9(2), 169-172.

Srivastava, H.D. 1939. The morphology and systematic relationship of a new parasite Mehrailla ovocaudatum gen. et sp. nov. of the family Acanthostomidae, from an Indian marine food fish. Indian J. vet. Sci. 9(2), 209-212.

Srivastava, H.D. 1939. Three new new parasites of the genus Acanthocolpus Lühe, 1906. Indian J. vet. Sci. 9(2), 213-216.

Srivastava, H.D. 1939. Two new trematodes of the family Monorchiidae Odhner, 1911, from Indian marine food fishes. Indian J. vet. Sci. 9(2), 233-236.

Srivastava, H.D. 1941. New hemiurids (trematoda) from Indian marine food fishes. Part II. Two new parasites of the genus Sterrhurus Looss, 1907. Indian J. vet. Sci. 11(1), 45-48.

Srivastava, H.D.1941. New hemiurids (Trematoda) from Indian marine food fishes. Part VIII. The morphology and systematic position of a new parasite- Indoderogenes purii, gen. et sp. nov. (subfamily

Derogenetinae). Indian J. vet. Sci. 11(1), 49-51.

Srivastava, H.D. 1941. New allocreadiids (Trematoda) from Indian marine food fishes. Part V. A new parasite of the genus Lepocreadioides Yamaguti, 1936. Indian J. vet. Sci. 11(1), 52-54.

Srivastava, H.D. 1942. New hemiurids (Trematoda) from Indian marine food fishes. Part III. Two new parasites of the genus Lecithocladium Lühe, 1901 (subfamily Dinurinae Looss, 1907). Parasitology. 34(1), 124-127.

Srivastava, H.D. 1942. New allocreadiids (Trematoda) from Indian marine food fishes. Part IV. The morphology and systematic position of a new genus, Horatrema, of digenetic trematodes. Parasitology. 34(1), 128-132.

Srivastava, L.P. 1966. The morphology of Lepidapedon cambriensis sp. nov. (Digenea:Lepocreadiidae) from the large intestine of Onos mustelus (L.), with a historical review of the genus. Ann. Mag. nat. Hist. Ser. 13, 9, 111-122.

Thomas, J.D. 1959. Trematodes of Ghanian Sub-littoral fishes. I. The family Monorchiidae. J. Parasit. 45, 95-113.

Velasquêz, C.C. 1959. Studies on the Family Bucephalidae

Poche, 1907 (Trematoda) from Philippine food fishes. J. Parasit. 45(2), 135-147.

Velasquez, C.C. 1961. Some digenetic trematodes of Philippine food fishes. J. Parasit. 47(3), 539-526.

Velasquez, C.C. 1962. Some hemiurid trematodes from Philippine fishes. J. Parasit. 48(4), 539-544.

Wolfgang, R.W. 1955. Studies on the trematode Stephanostomum baccatum (Nicoll, 1907). IV. The variation of the adult morphology and the taxonomy of the genus. Canad. J. Zool. 33(3), 129-142.

Yamaguti, S. 1934. Studies on the helminth fauna of Japan. Part 2. Trematodes of fishes, I. Jap. J. Zool. 5(3), 249-541.

Yamaguti, S. 1938. Studies on the helminth fauna of Japan. Part 21. Trematodes of fishes, IV. Publ. by author, 139 pp.

Yamaguti, S. 1938. Studies on the helmingh fauna of Japan. Part 24. Trematodes of fishes, V. Jap. J. Zool. 8(1), 15-74.

Yamaguti, S. 1939. Studies on the helminth fauna of Japan. Part 26. Trematodes of fishes, VI. Jap. J. Zool. 8(2), 211-230.

Yamaguti, S. 1940. Studies on the helminth fauna of Japan. Part 31. Trematodes of fishes, VII, Jap.

J. Zool. 9(1), 35-108.

Yamaguti, S. 1951. Studies on the helminth fauna of Japan. Part 44. Trematodes of fishes, IX. Arb. med. Fak. Okayama. 7(4), 247-282.

Yamaguti, S. 1952. Parasitic worms mainly from Celebes. Part I. New digenetic trematodes of fishes. Acta Med. Okayama. 8(2), 146-198.

Yamaguti, S. 1953. Parasitic worms mainly from Celebes. Part 3. Digenetic trematodes of fishes, II. Acta Med. Okayama. 8(3), 257-295.

Yamaguti, S. 1954. Systema Helminthum Part I. Digenetic trematodes of fishes. Tokyo. pp. 405.

Yamaguti, S. 1958. Systema Helminthum. Vol. I. The digenetic trematodes of vertebrates. Part I-II. New York. pp. 1575.

Yamaguti, S. 1959. Studies on the helminth fauna of Japan. Part 54. Trematodes of fishes, XIII. Pbls. Seto mar. biol. Lab. 7(2), 243-262.

PLATE I

Figure 1. Prosorhynchus epinepheli (ventral view)

Figure 2. Prosorhynchus atlanticus (ventral view)

Figure 3. Prosorhynchus chorinemi (ventral view)

Figure 4. Prosorhynchus tsengi (ventral view)

Figure 5. Rhipidocotyle septapapillata (ventral view)

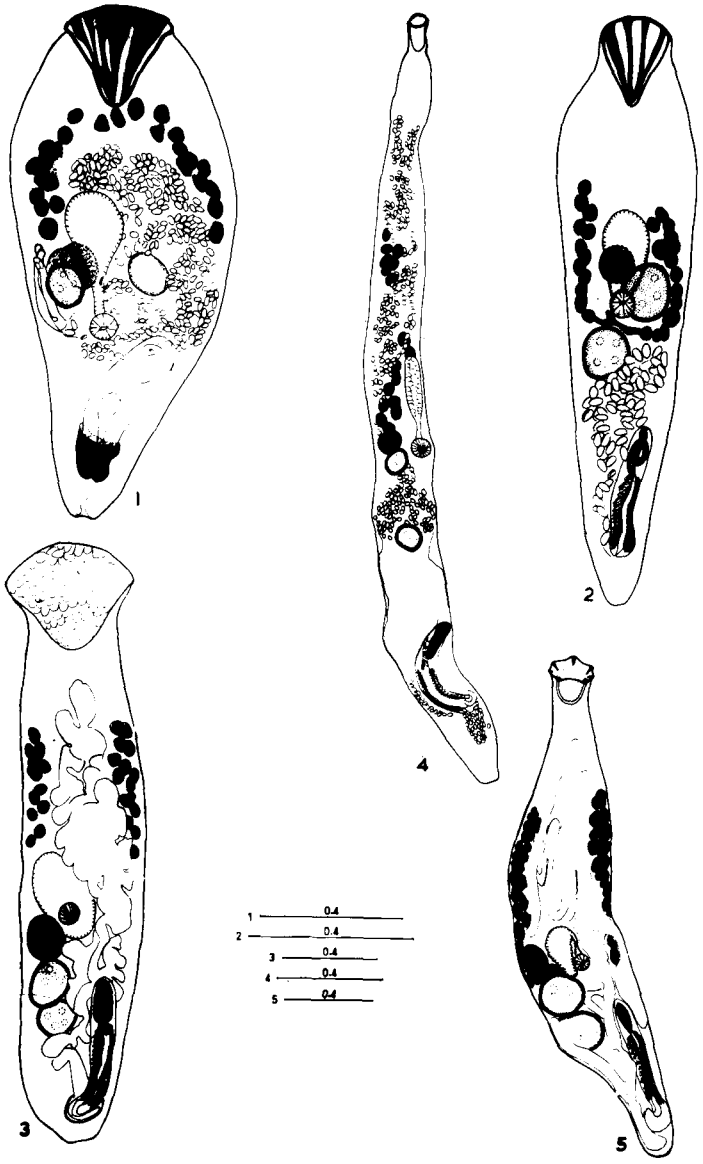

1
2
3
4
5
1 0.4
2 0.4
3 0.4
4 0.4
5 0.4

PLATE II

Figure 6. *Alcicornis thapari* (dorsal view)

Figure 7. Anterior part of a paratype of *Alcicornis thapari*

Figure 8. *Dollfustrema* sp. (ventral view)

Figure 9. *Pseudallacanthochasmus grandispinus* (ventral view)

Figure 10. *Metadena karthai* (ventral view)

Figure 11. *Neometadena lutiani* (ventral view)

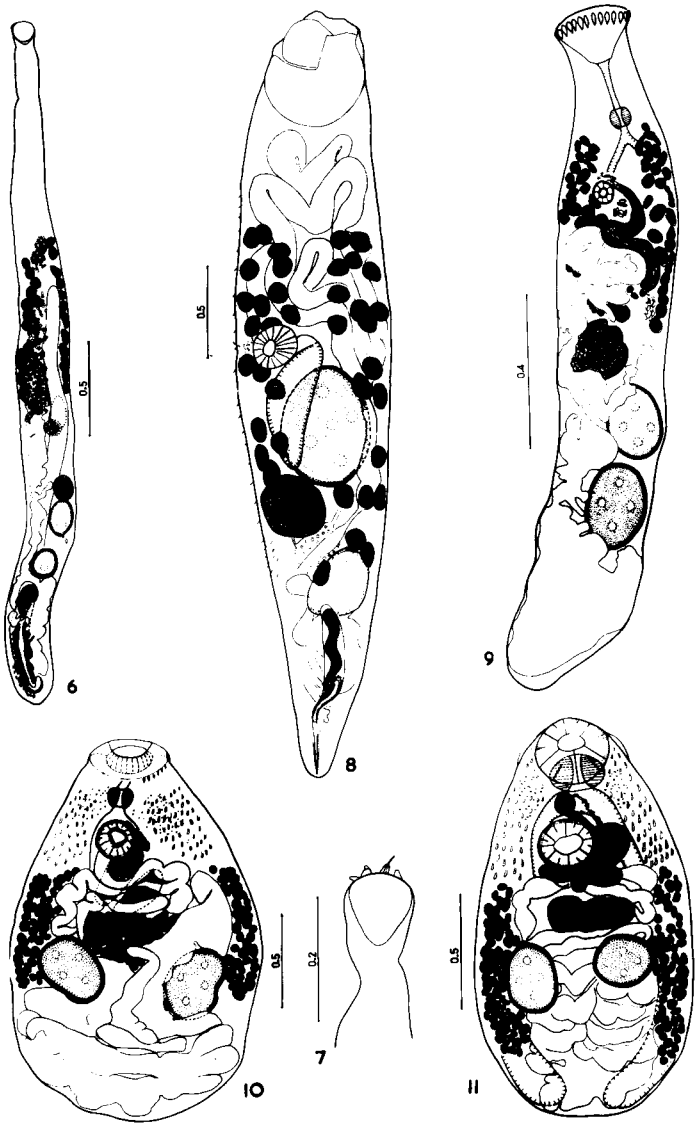

0.5
6
0.5
8
0.4
9
0.5
10
0.2
7
0.5
11

PLATE III

Figure 12. Centrovarium marinum (ventral view)

Figure 13. Monascus typicus (ventral view)

Figure 14. Calitrema bispinata (ventral view)

Figure 15. Calitrema bispinata, Anterior part.

Figure 16. Bacciger nicolli (ventral view)

Figure 17. Bacciger cochinensis (ventral view)

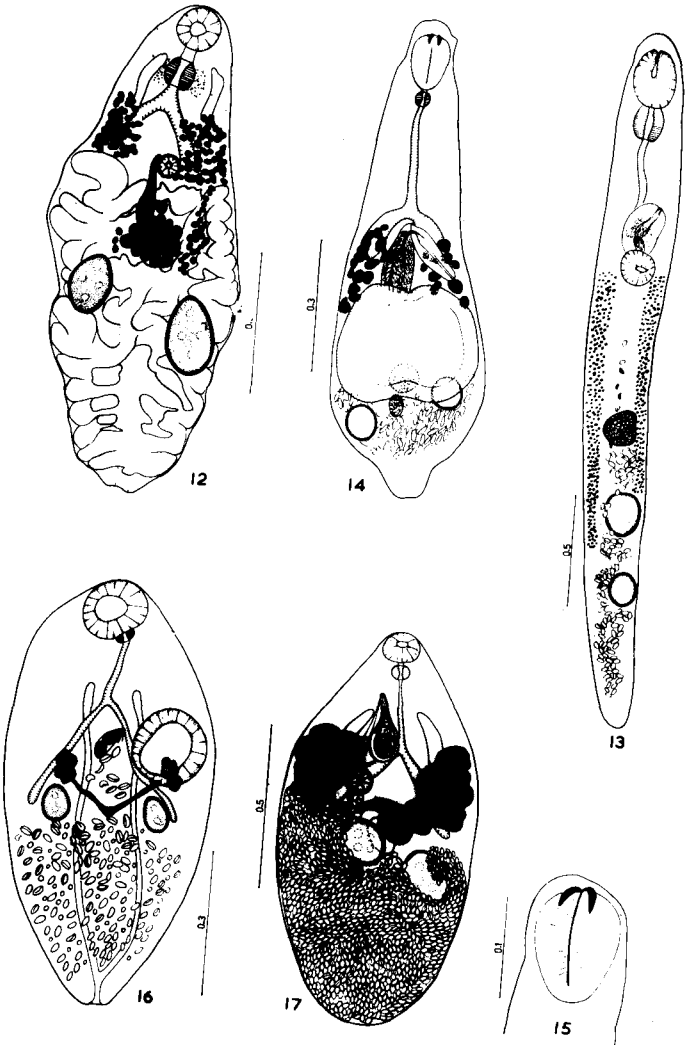

12
14
13
16
17
15

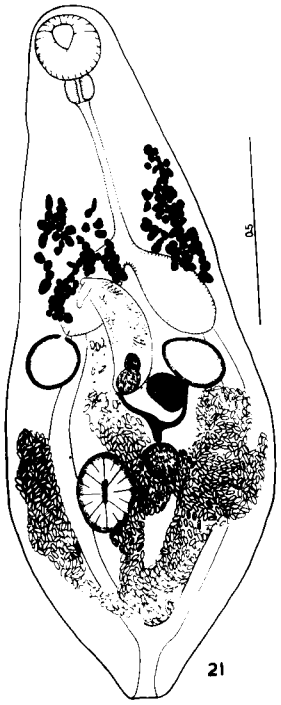
PLATE IV

Figure 18. Allobacciger macrorchis (ventral view)

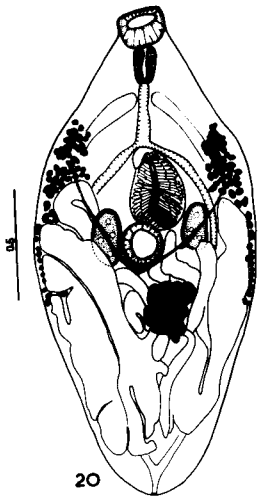
Figure 19. Faustula gangetica (ventral view)

Figure 20. Faustula basiri (ventral view)

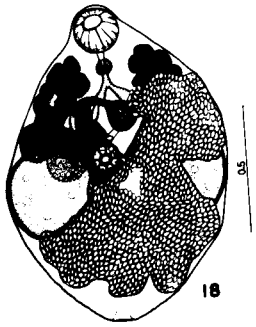
Figure 21. Jonesiella pomacanthi (ventral view)



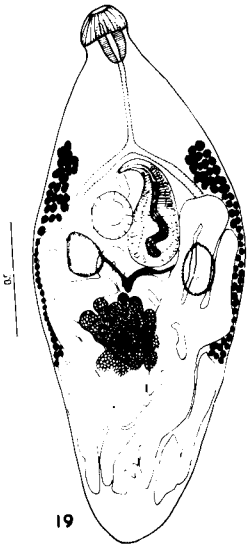
21



20



18



19

PLATE V

Figure 22. Tergestia laticollis (ventral view)

Figure 23. Paracalitrema acanthocirrus (ventral view)

Figure 24. Paradiscogaster farooqii (ventral view)

Figure 25. Opistholebes cotylophorus (ventral view)

Figure 26. Opistholebes amplicoelus (dorsal view)

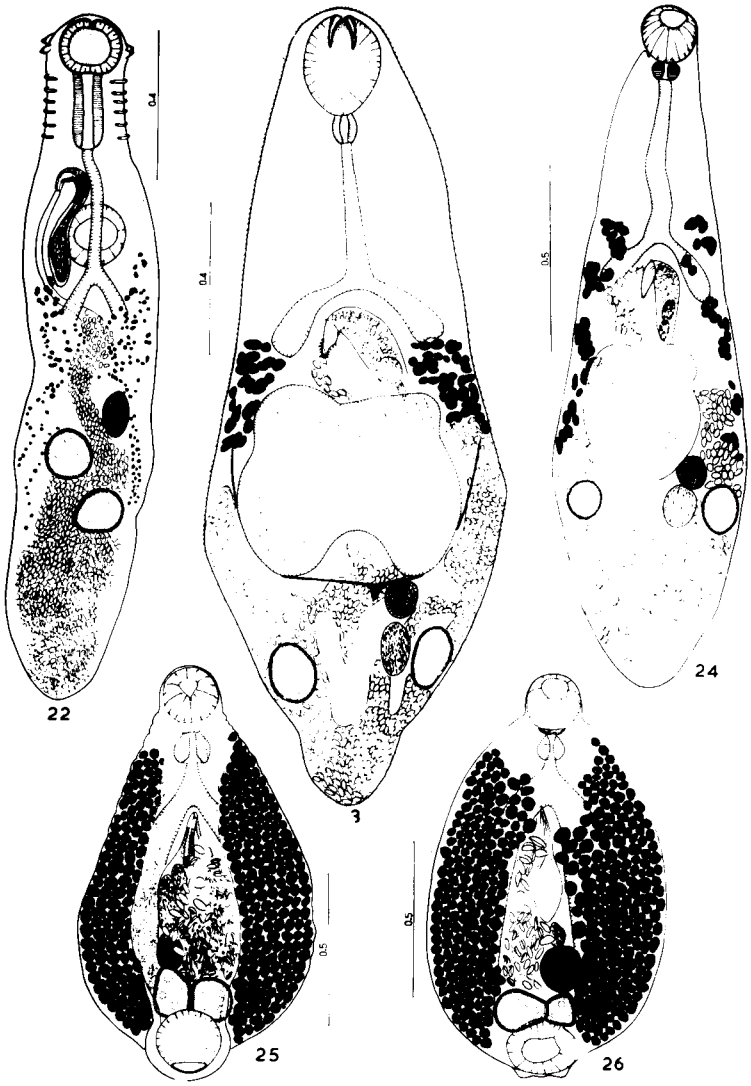

0.4
22
0.4
3
0.5
24
0.5
25
0.5
26

PLATE VI

Figure 27. Tetrodonicola biacetabulata (ventral view)

Figure 28. Posterior part of a paratype of Tetrodonicola biacetabulata

Figure 29. Aephridiogenes senegalensis (ventral view)

Figure 30. Lepocreadioides indicum (ventral view)

Figure 31. Transversocreadium cablei (ventral view)

Figure 32. Crassicutis karwarensis (ventral view)

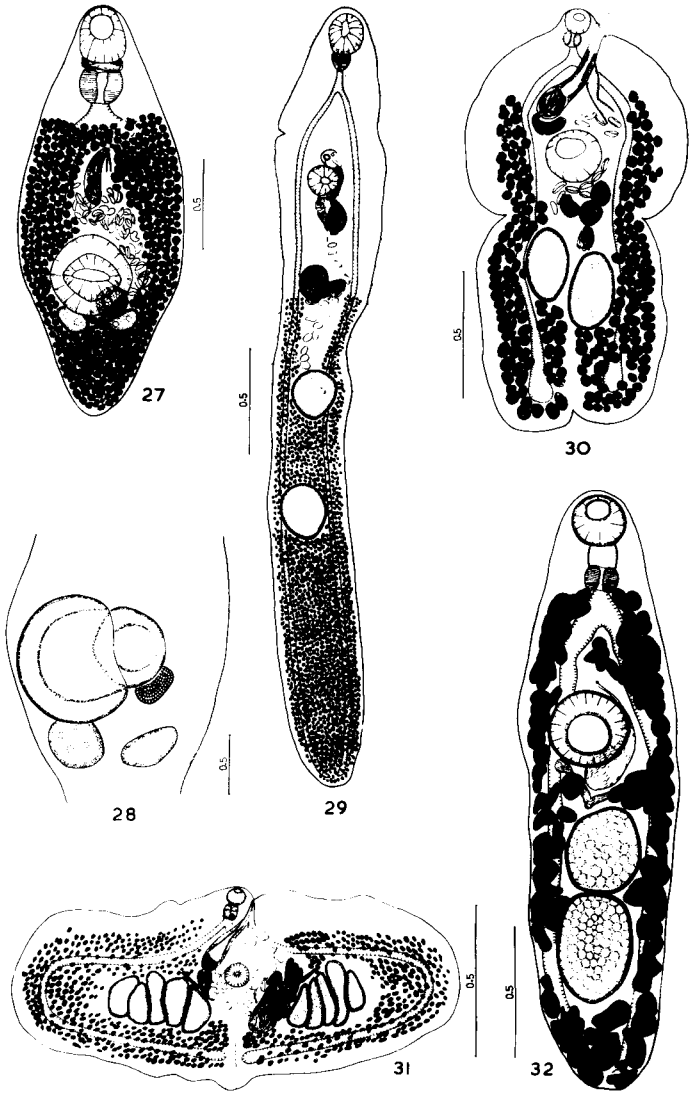

0.5
27
0.5
29
0.5
30
0.5
28
0.5
31
0.5
32

PLATE VII

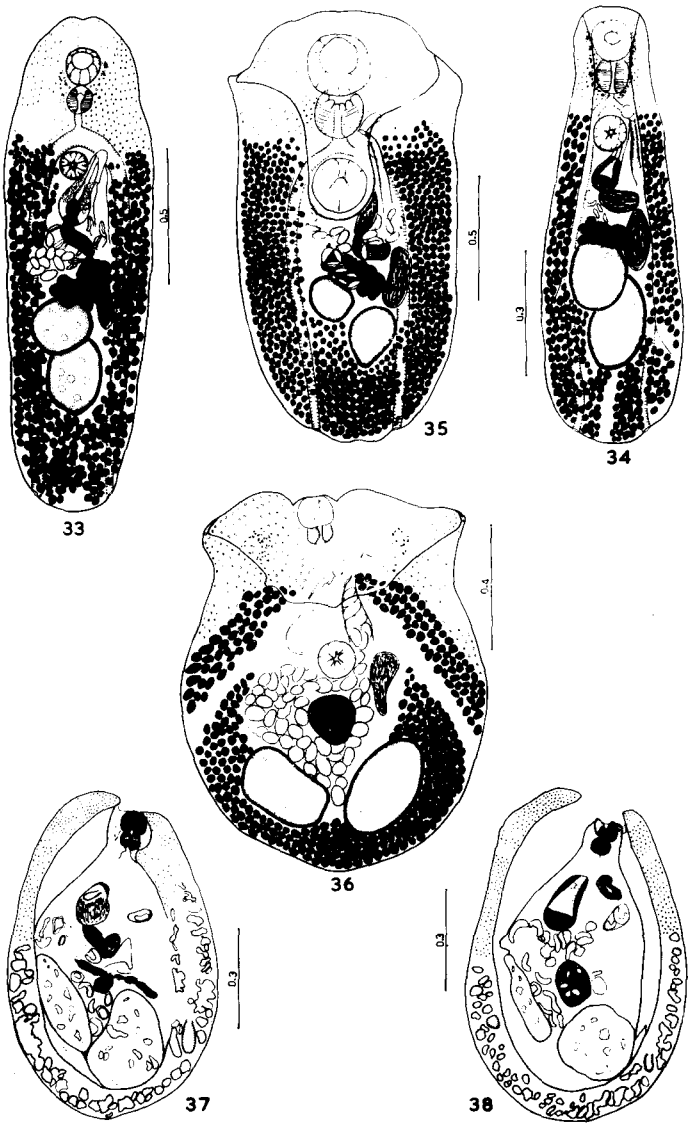
Figure 33. Diploproctodaeum plicitum from Tetrodon Lunaris (ventral view)

Figure 34. Diploproctodaeum plicitum from Gastrophysus spadiceus (ventral view)

Figure 35. Diploproctodaeum anteroporum (ventral view

Figure 36. Aproctodaeum ovatum (ventral view)

Figures 37 and 38. Aproctodaeum ovatum, frontal sections



33 35 34

36

37 38

PLATE VIII

Figure 39. Lepidapedon manteri (ventral view)

Figure 40. Lepidapedon longivesiculum (ventral view)

Figure 41. Pseudocreadium patellare (ventral view)

Figure 42. Rhombocreadium symmetrorchis (ventral view)

Figure 43. Plagioporus longicaudus (ventral view)

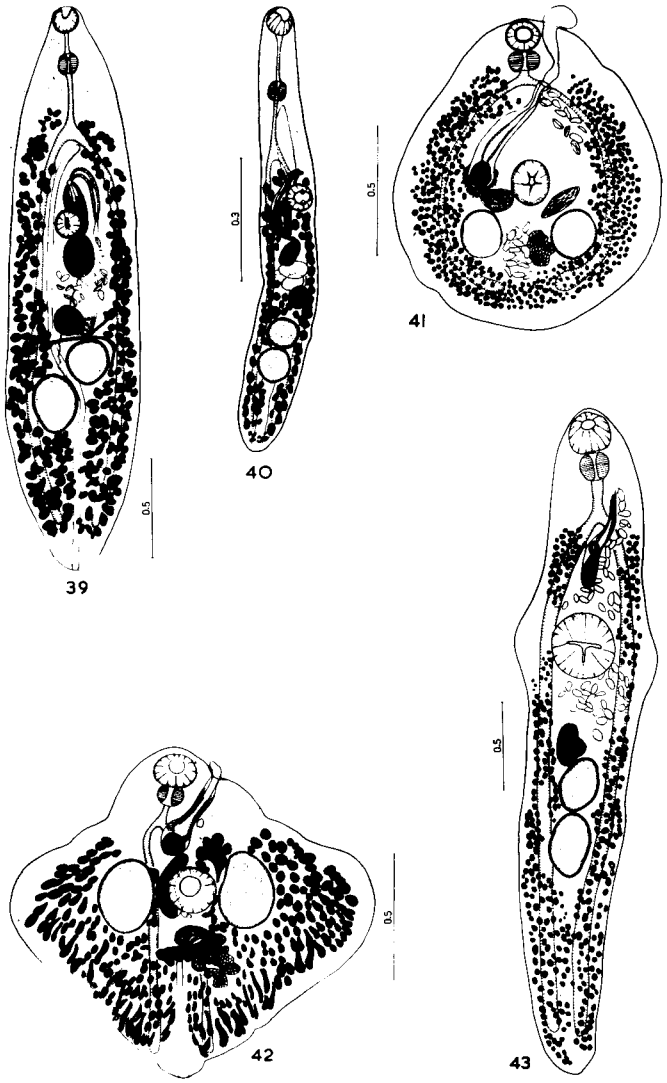

0.5
39
0.3
40
0.5
41
0.5
42
0.5
43

PLATE IX

Figure 44. Paropecoelus indicus (lateral view)

Figure 45. Dactylostomum sulphurei (lateral view)

Figure 46. Pseudopecoelina elongata (lateral view)

Figure 47. Pseudopecoeloides chorinemi (lateral view)

Figure 48. Podocotyloides parupenei (ventral view)

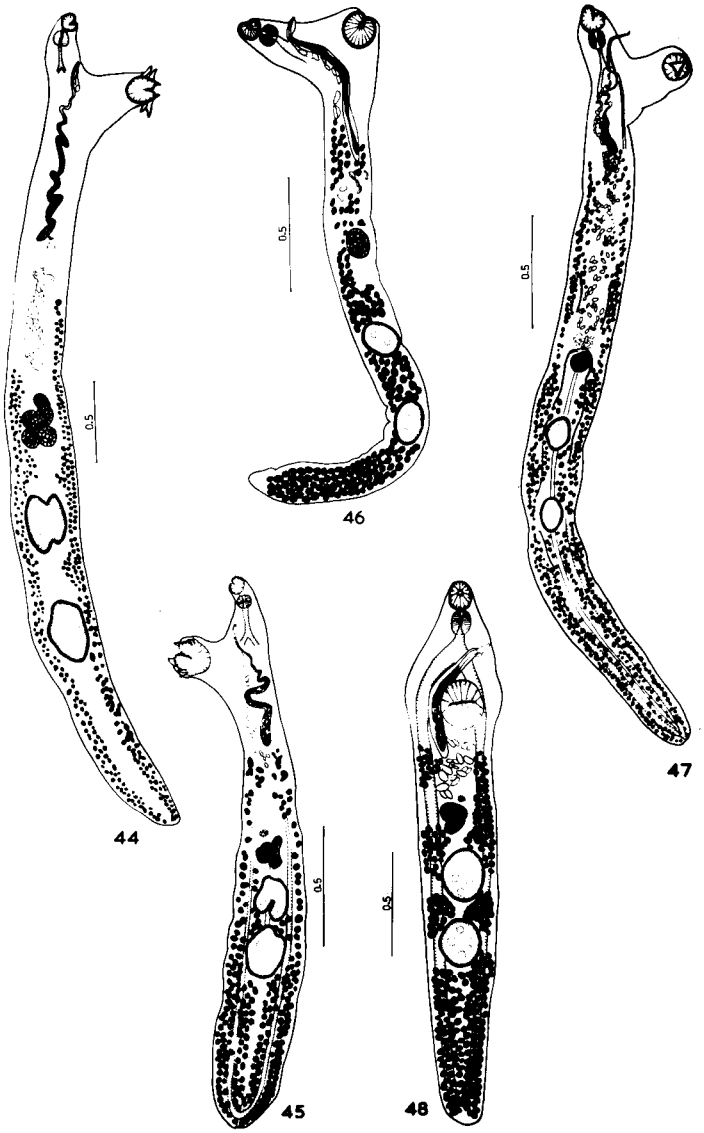

0.5
44
0.5
46
0.5
47
0.5
45
0.5
48

PLATE X

Figure 49. Hamacreadium mutabile from Lutianus rivulatus (ventral view)

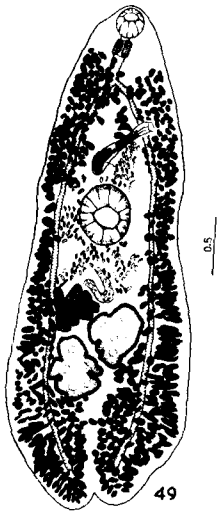
Figure 50. Hamacreadium mutabile from Lutianus fulviflamma (ventral view)

Figure 51. Hamacreadium krusadaiensis (ventral view)

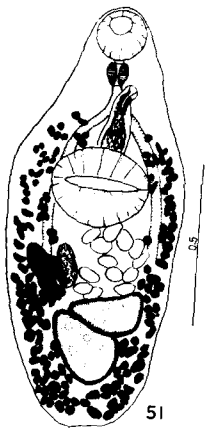
Figure 52. Hamacreadium equulai (ventral view)

Figure 53. Opegaster paramacrorchis (ventral view)

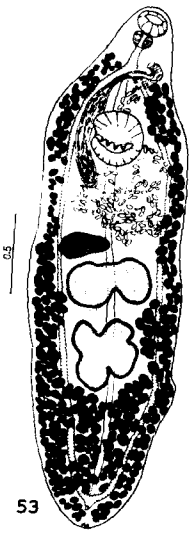
Figure 54. Opegaster trachinocephali (ventral view)



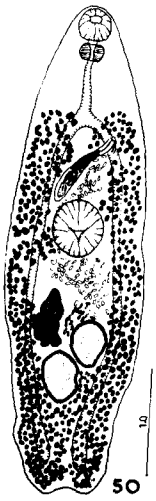
49



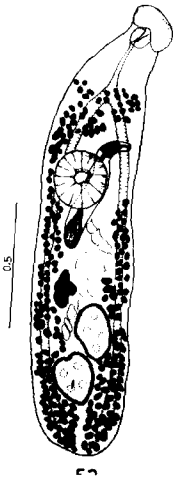
51



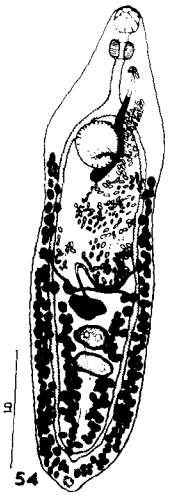
53



50



52



54

PLATE XI

Figure 55. Decemtestis mehrai from Pomadasys maculatus (ventral view)

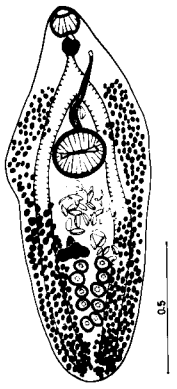
Figure 56. Decemtestis mehrai from Lutianus johnii (ventral view)

Figure 57. Decemtestis mehrai from Cynoglossus bilineatus (ventral view)

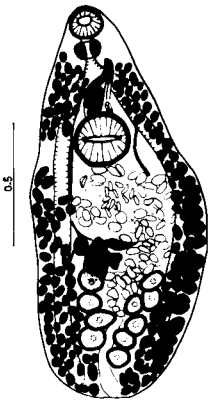
Figure 58. Decemtestis brevicirrus (dorsal view)

Figure 59. Allodecemtestis biacetabulata (ventral view)

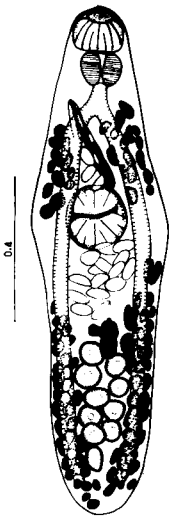
Figure 60. Allodecemtestis biacetabulata showing interrupted vitellaria (ventral view)



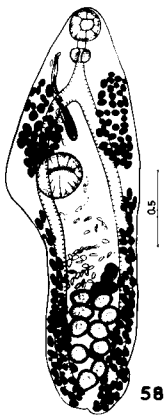
55



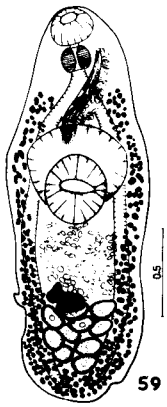
56



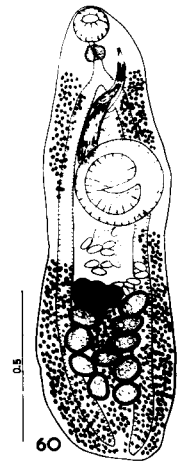
57



58



59



60

PLATE XII

Figure 61. Helicometrina septorchis from serranus maculatus (dorsal view)

Figure 62. Helicometrina septorchis from Johnius glaucus (ventral view)

Figure 63. Helicometrina septorchis from Serranus maculatus (dorsal view)

Figure 64. Helicometrina septorchis from Serranus maculatus (ventral view)

Figure 65. Helicometrina septorchis from Lutianus quinquilinearis (ventral view)

Figure 66. Helicometrina pandei (ventral view)

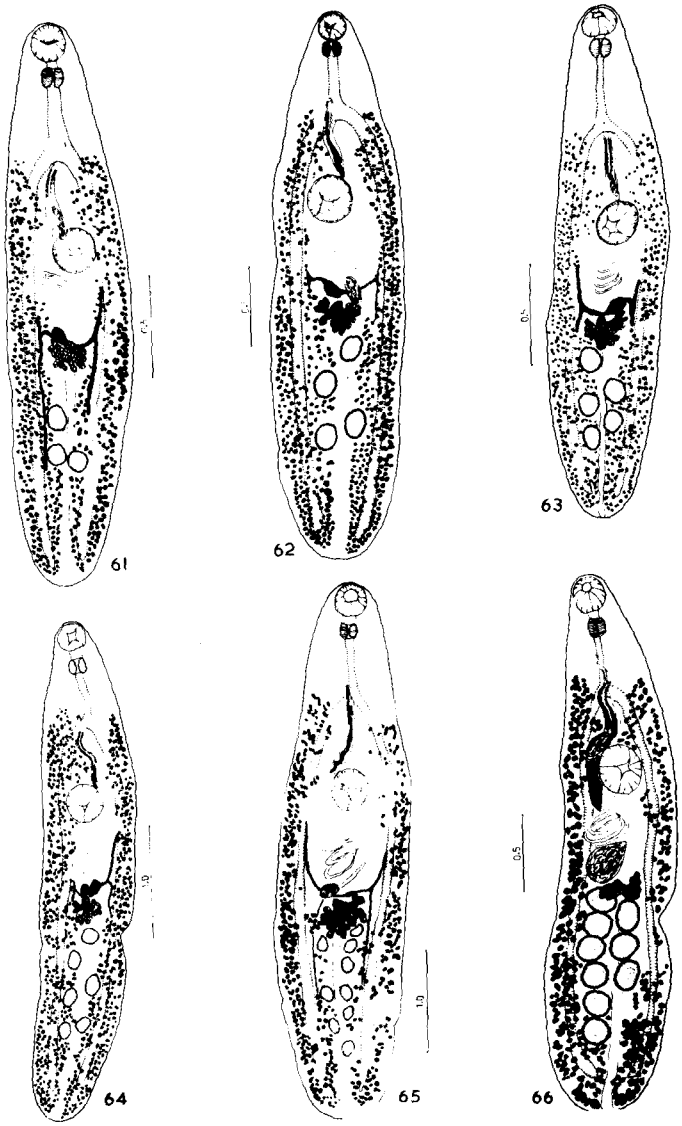

61
62
63
64
65
66

PLATE XIII

Figure 67. Spelotrema sp. (ventral view)

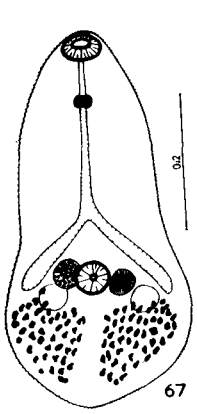
Figure 68. Elongoparorchis pneumatis (ventral view)

Figure 69. Mehratrema dollfusi (ventral view)

Figure 70. Lasiotocus pomadasi (ventral view)

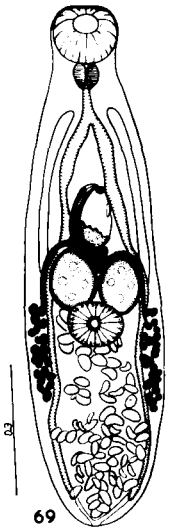
Figure 71. Anaporrhutum albidum (ventral view)

Figure 72. Pleorchis sciaenae (ventral view)

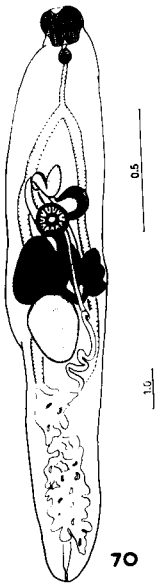


67

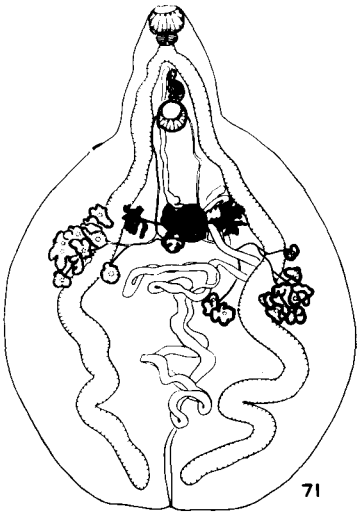
68



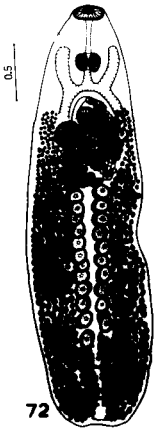
69



70



71



72

PLATE XIV

Figure 73. Bivesiculoides callyodoni

Figure 74. Prosogonotrema pritchardae (ventral view)

Figure 75. Acanthocolpus liodorus (lateral view)

Figure 76. Acanthocolpus lühei (lateral view)

Figure 77. Acanthocolpus tenuis (lateral view)

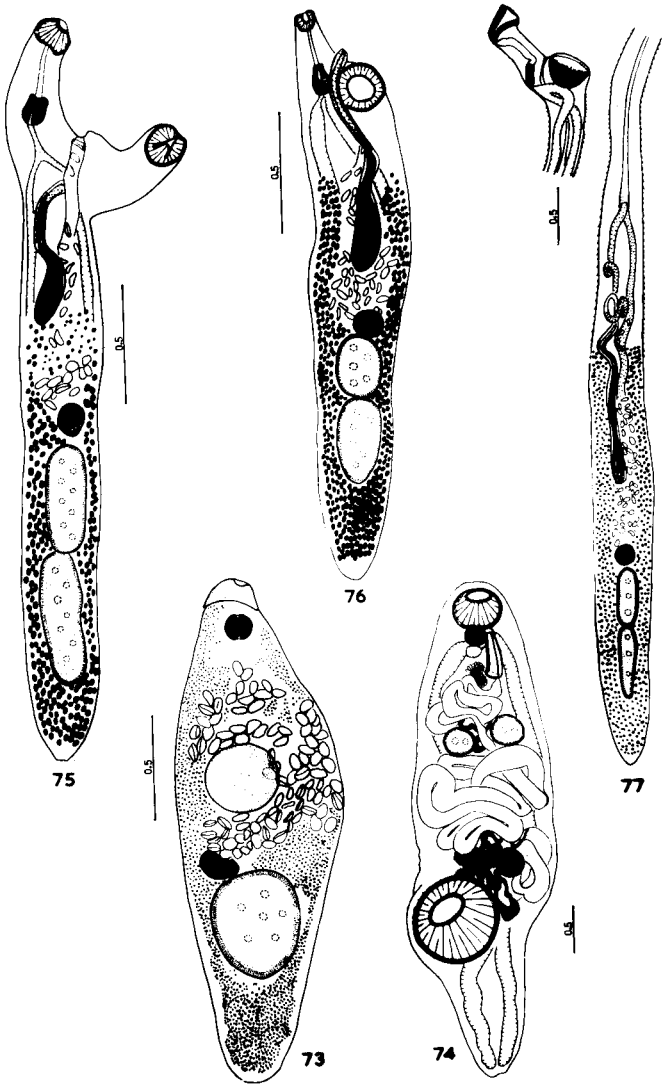

0.5
75
0.5
76
0.5
77
0.5
73
0.5
74

PLATE XV

Figure 78. Stephanostomum nemipteri (ventral view)

Figure 79. Stephanostomum attenuatum (dorsal view)

Figure 80. Stephanostomum adinterruptum (ventral view)

Figure 81. Tormopsolus mirzai (ventral view)

Figure 82. Hymenocotta mulli (ventral view)

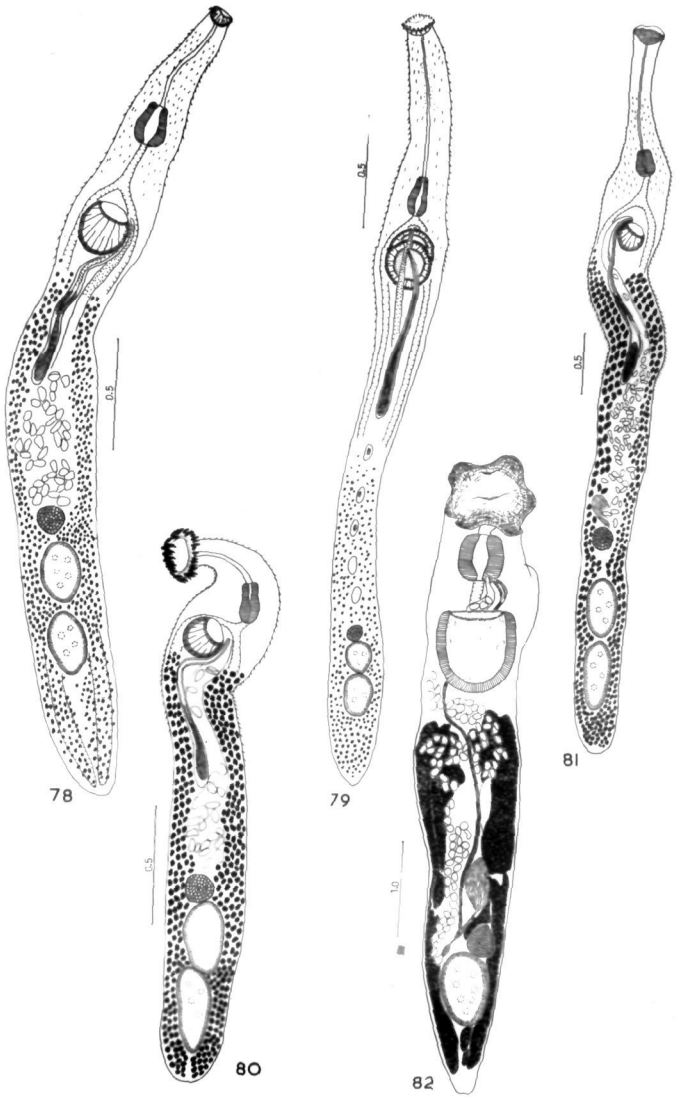

0.5
78
0.5
80
0.5
79
1.0
82
0.5
81

PLATE XVI

Figure 83. Lecithocladium parviovum (ventral view)

Figure 84. Lecithocladium megalaspis (ventral view)

Figure 85. Lecithocladium glandulum (ventral view)

Figure 86. Erilepturus lemeriensis (ventral view)

Figure 87. Erilepturus hamati (ventral view)

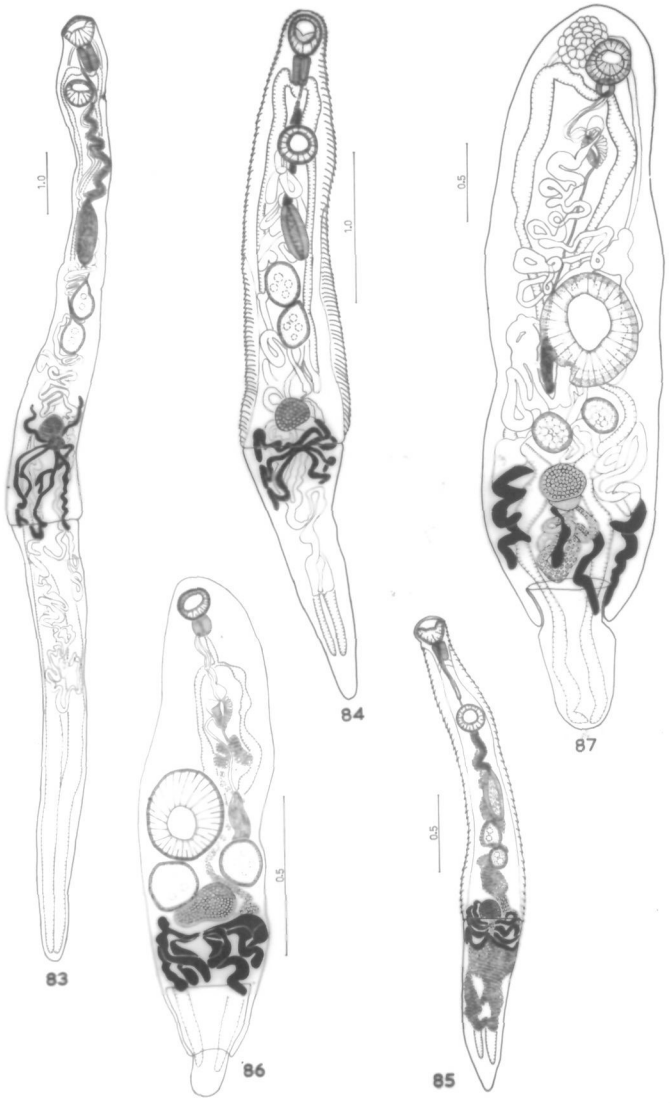

1.0
1.0
0.5
0.5
0.5
83
84
87
86
85

PLATE XVII

Figure 88. Parahemiurus dussumieri (ventral view)

Figure 89. Parahemiurus brevisinus (Ventral view)

Figure 90. Parahemiurus indicus (ventral view)

Figure 91. Tubulovesicula angusticauda (ventral view)

Figure 92. Tubulovesicula angusticauda Acetabular region (ventral view)

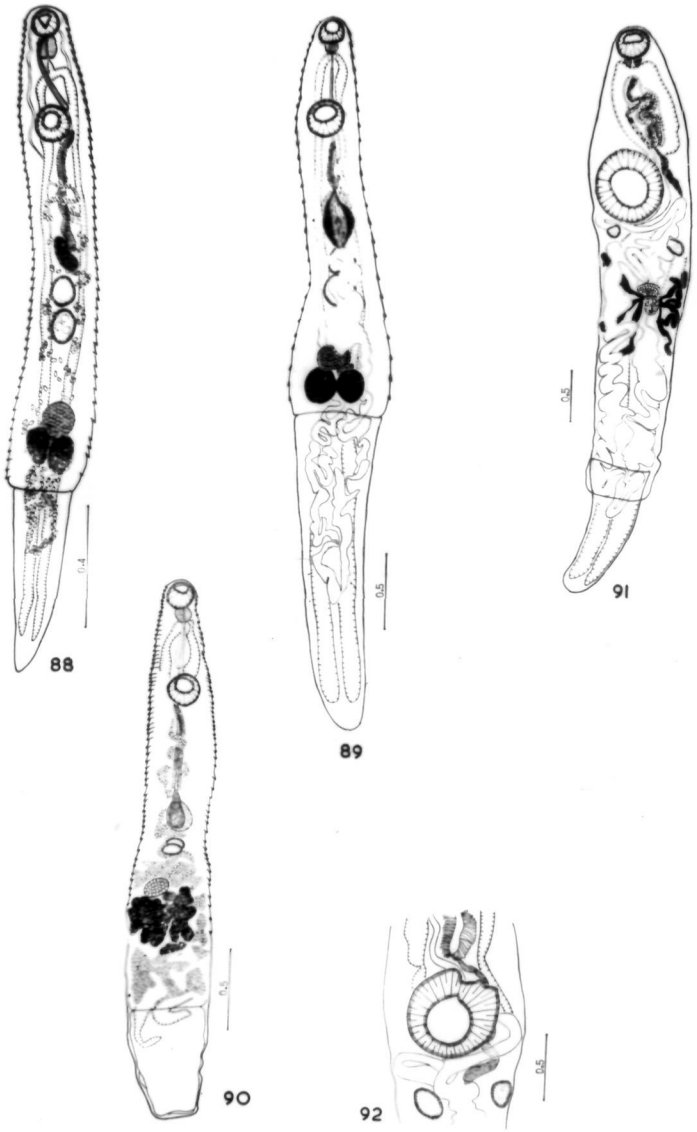

0·4
88
0·5
89
0·5
91
0·5
90
0·5
92

PLATE XVIII

Figure 93. *Allostomachicola secundus* (ventral view)

Figure 94. *Stomachicola muraenesocis* Anterior part (ventral view)

Figure 95. *Aphanurus acanthophallus* (lateral view)

Figure 96. *Aponurus drepani* (ventral view)

Figure 97. *Hysterolecitha scatophagi* (ventral view)

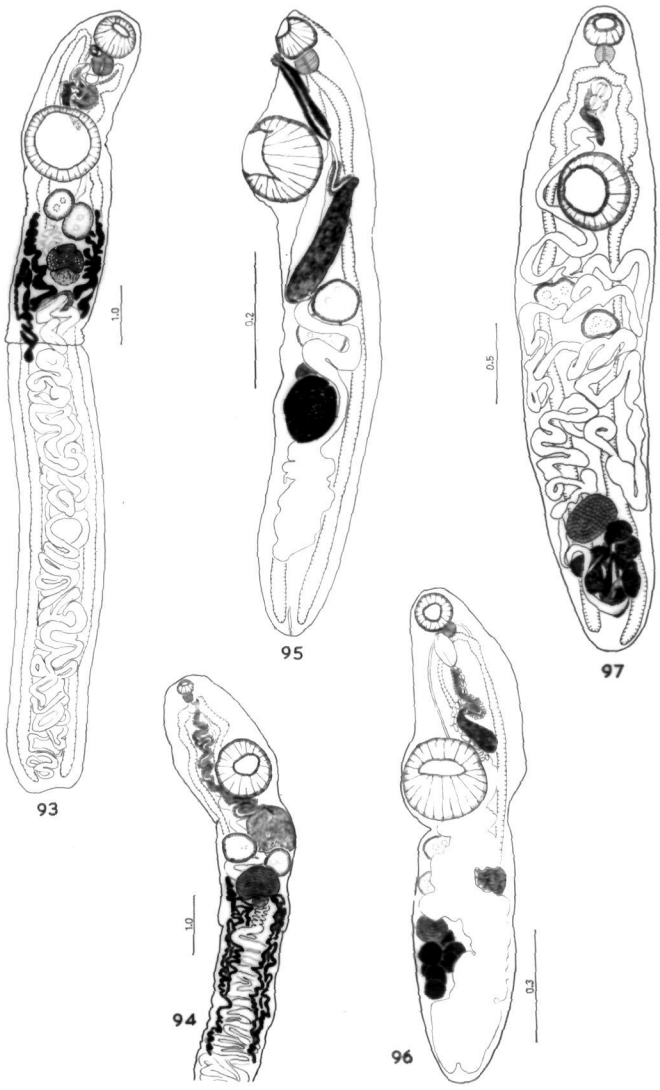
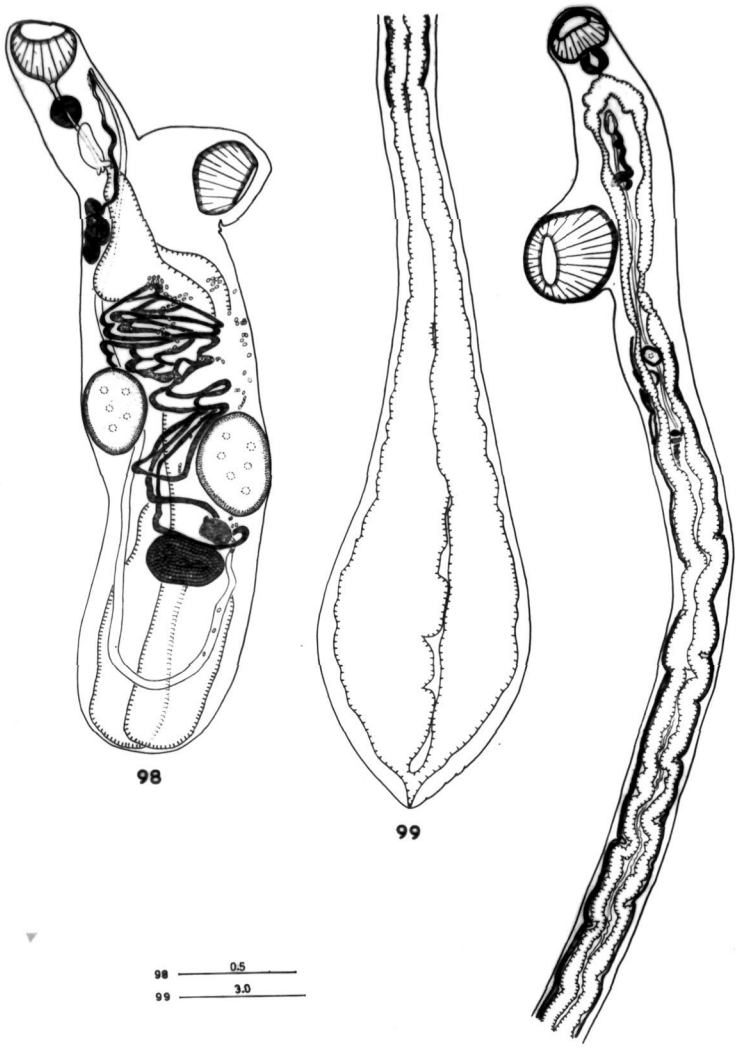

1.0
93
0.2
95
0.5
97
1.0
94
0.2
96

PLATE XIX

Figure 98. Tetrochetus coryphaenae (lateral view)

Figure 99. Uroproctinella attenuata (lateral view)


98
99
98 0.5
99 3.0